US009738301B2

(12) **United States Patent**
Vezina et al.

(10) **Patent No.: US 9,738,301 B2**
(45) **Date of Patent: Aug. 22, 2017**

(54) **SNOWMOBILE FOOTRESTS**

(71) Applicant: **BOMBARDIER RECREATIONAL PRODUCTS INC.**, Valcourt (CA)

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(73) Assignee: **BOMBARDIER RECREATIONAL PRODUCTS INC.**, Valcourt (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/788,624**

(22) Filed: **Jun. 30, 2015**

(65) **Prior Publication Data**

US 2016/0194021 A1 Jul. 7, 2016

Related U.S. Application Data

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(51) **Int. Cl.**
B62B 17/06 (2006.01)
B62M 27/02 (2006.01)

(52) **U.S. Cl.**
CPC ***B62B 17/063*** (2013.01); ***B62M 27/02*** (2013.01); *B62M 2027/023* (2013.01); *B62M 2027/025* (2013.01); *B62M 2027/028* (2013.01)

(58) **Field of Classification Search**
CPC B62B 17/063; B62B 17/065; B62M 27/02; B62M 2027/023; B62M 2027/028
USPC 180/190
See application file for complete search history.

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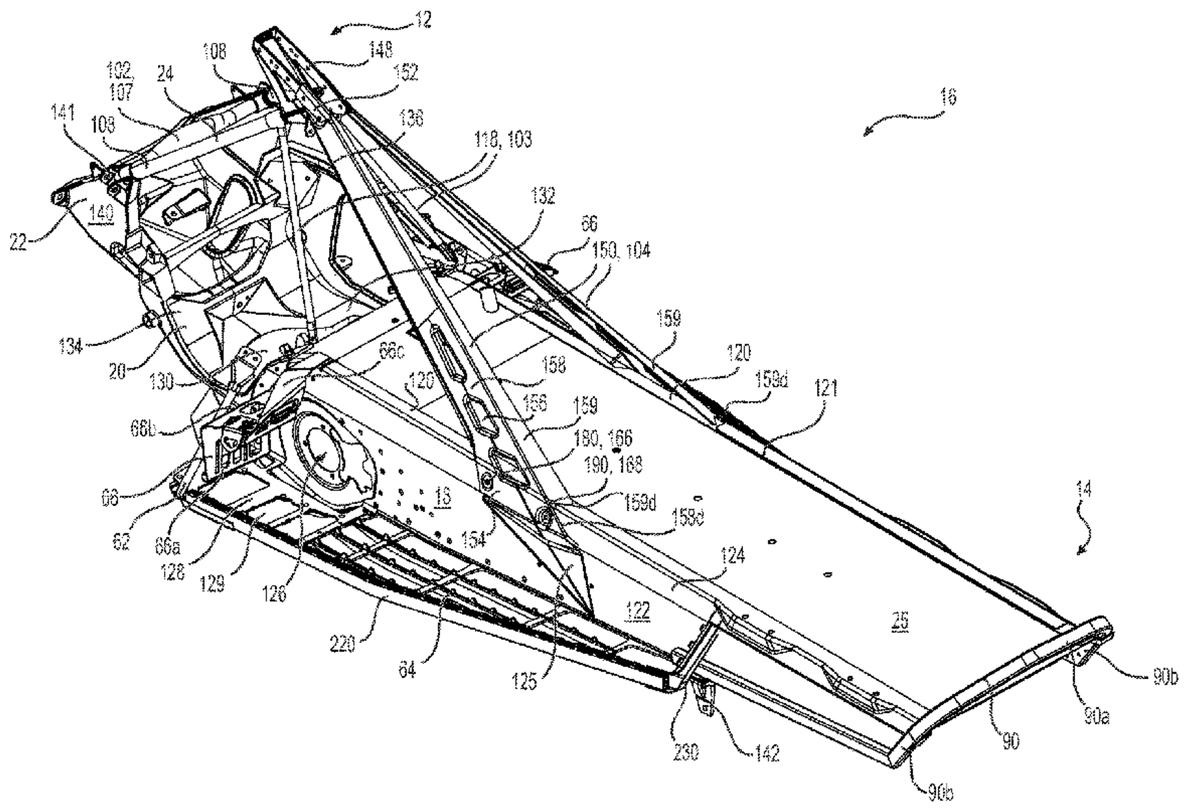
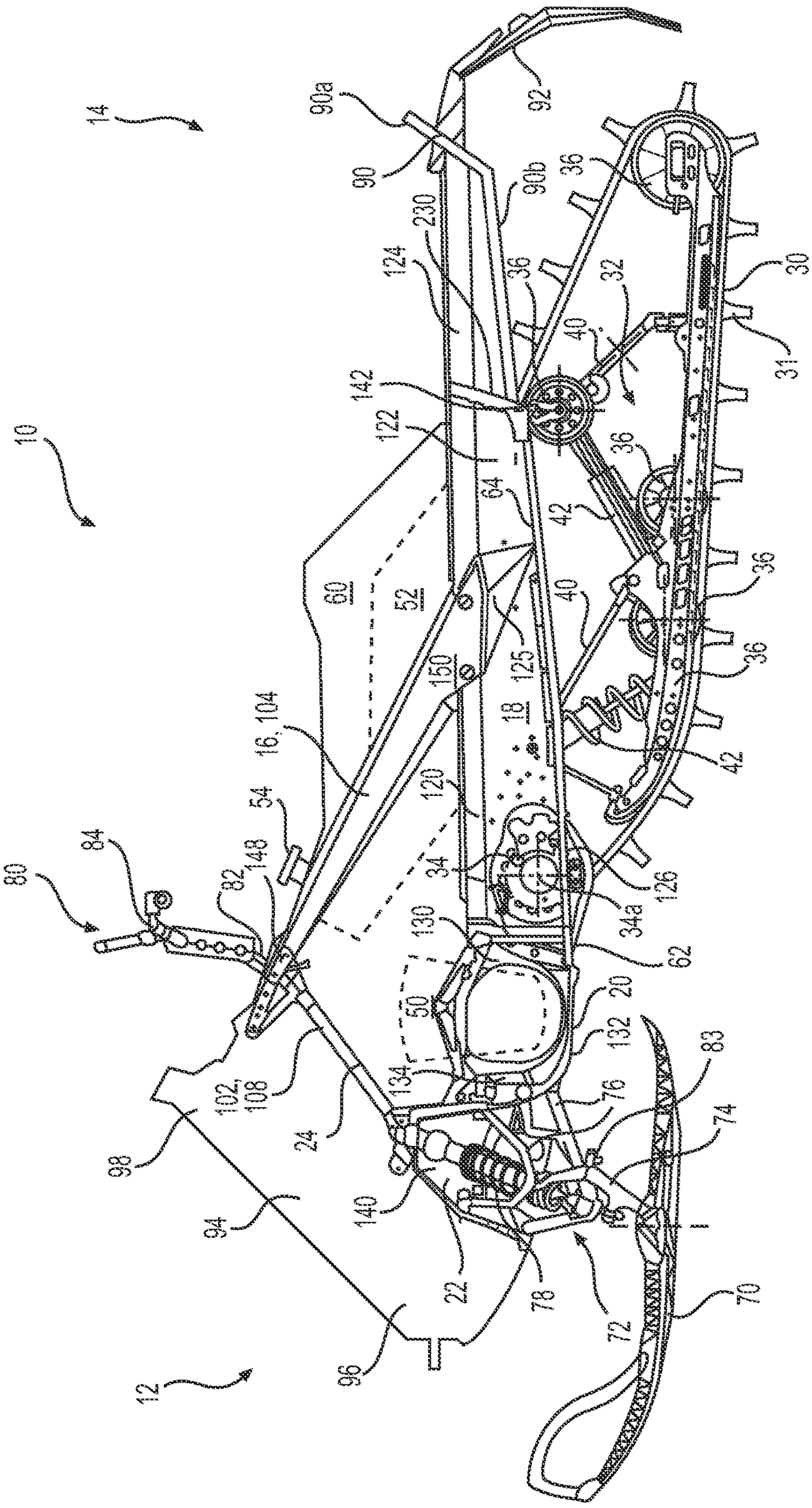
Primary Examiner — Tony Winner
(74) *Attorney, Agent, or Firm* — BCF LLP

(57) **ABSTRACT**

A snowmobile footrest adapted to be disposed on a side of a snowmobile tunnel includes a plurality of interconnected ribs. At least one first rib extending in a first direction includes an upper first rib surface and a lower first rib surface defining a first rib height therebetween. A pair of vertical first rib surfaces, extending generally in a vertical direction between the upper and lower first rib surfaces, define a first rib thickness therebetween. The first rib height is greater than the first rib thickness. At least one second rib is connected to the at least one first rib. Each second rib extends in a second direction, the second direction being at an angle with respect to the first direction. The at least one first rib and the at least one second rib define at least one space therebetween. Snowmobiles having the footrests are also disclosed.

26 Claims, 30 Drawing Sheets

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40
36
150
125
18
16, 104
120
42
54
84
148
82
80
34
126
34a
130
62
20
50
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102, 108
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24
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140
94
22
78
72
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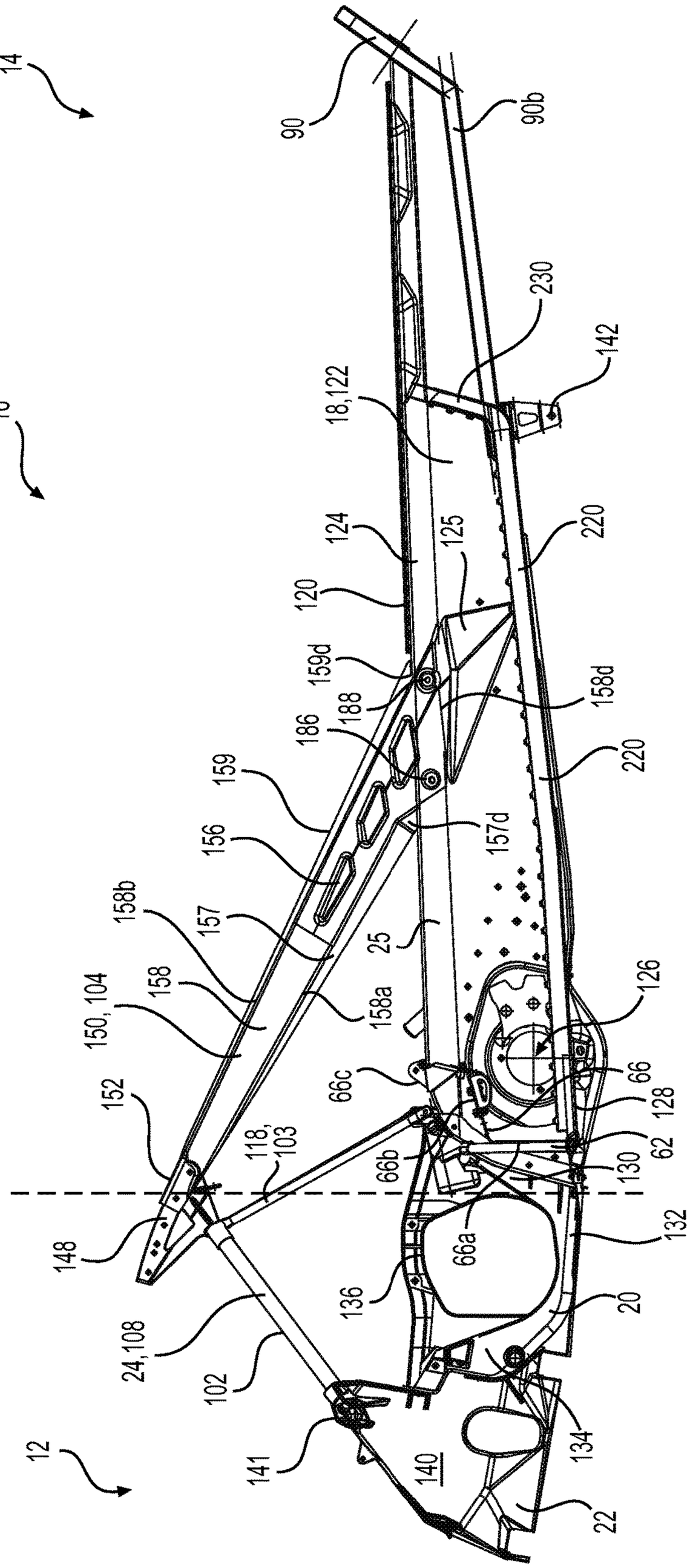
12
96

FIG. 1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158b
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150, 104
158a
126
152
66c
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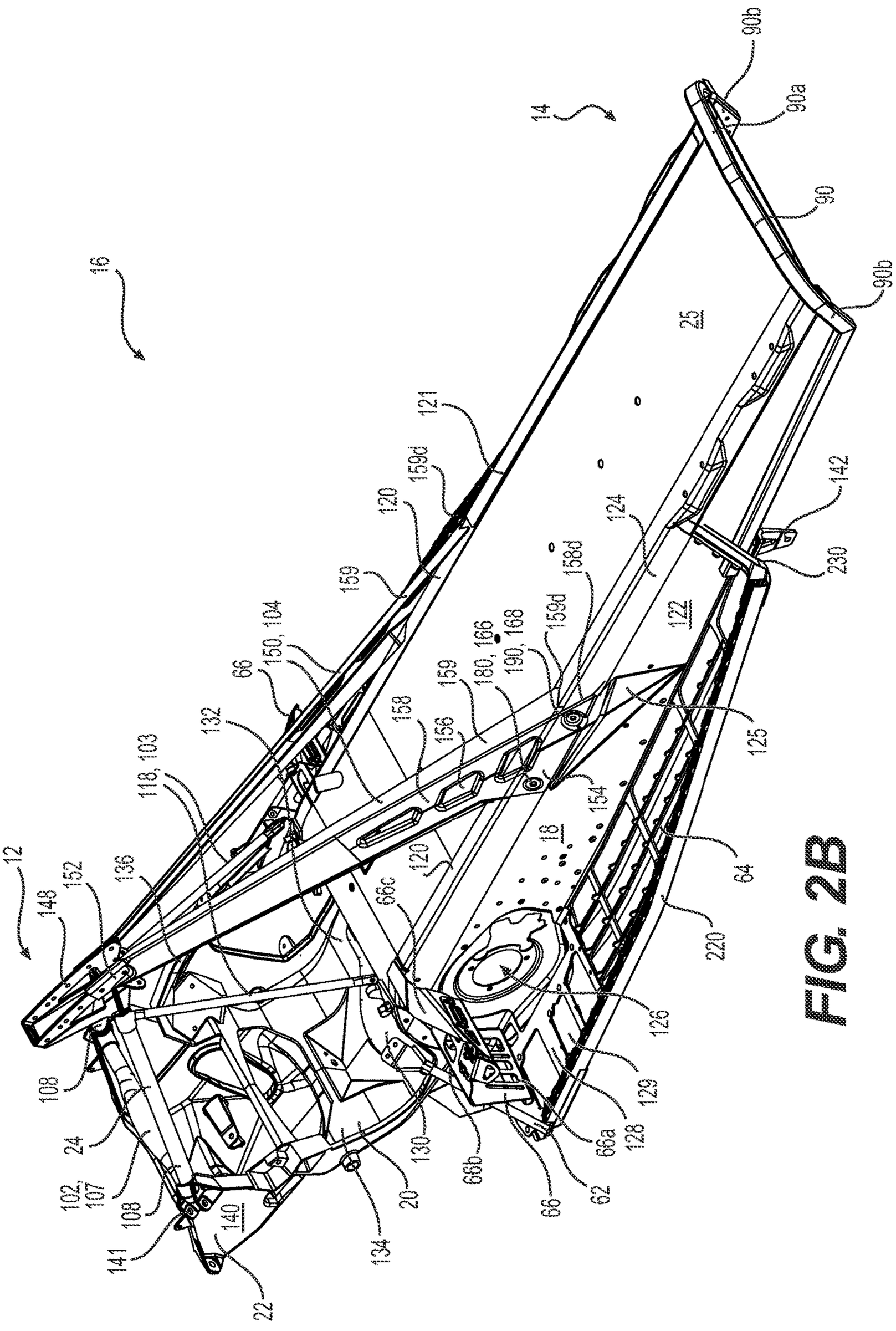
FIG. 2A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190, 168
159d
158d
124
122
125
154
18
120
66c
64
220
126
129
66a
128
66b
130
20
134
66
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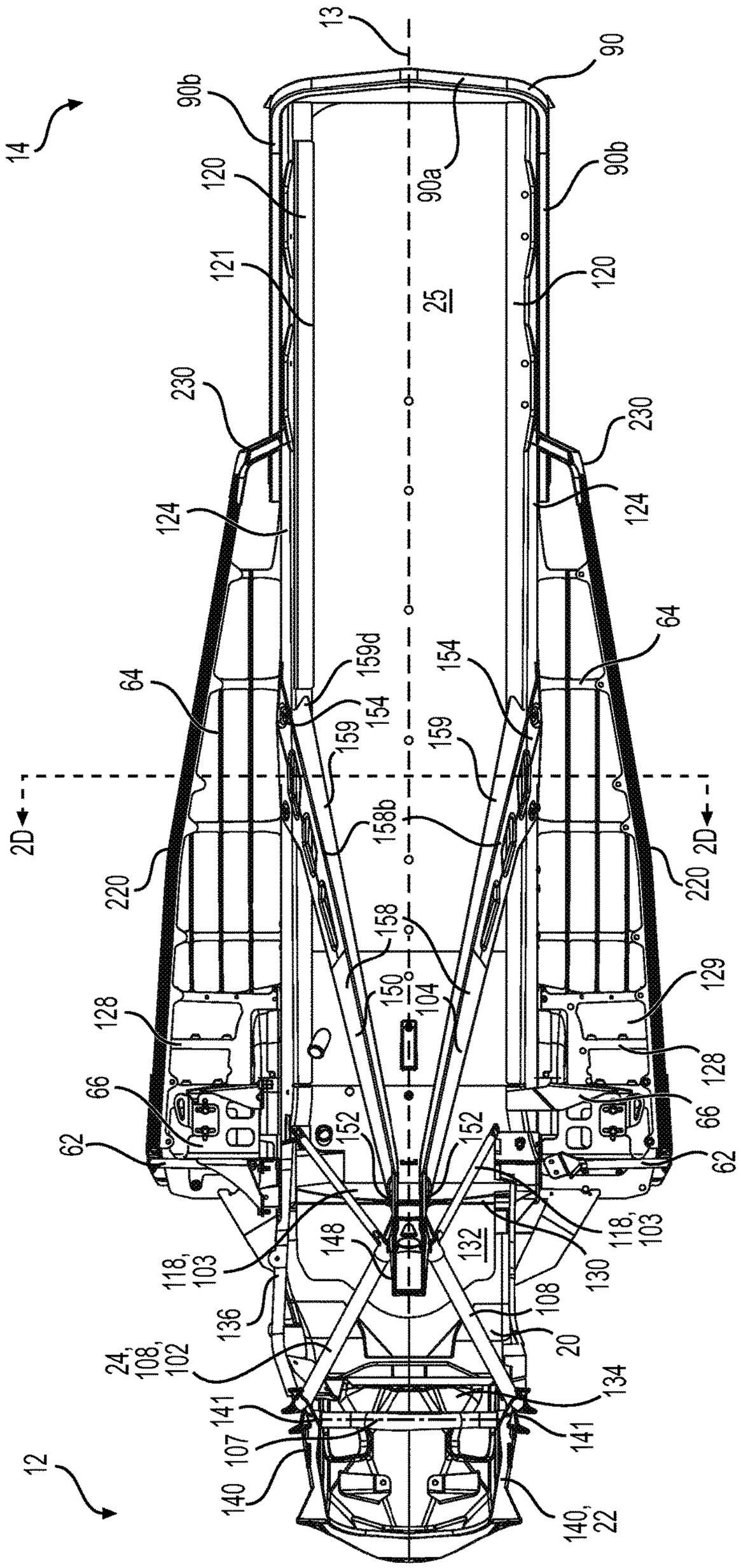
141
140
22
24
108
14
90b
90a
90
25
142
230

FIG. 2B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90b
16
121
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159
159
158b
2D
2D
220
220
158
150
104
129
128
128
66
66
62
62
152
152
118,
103
118,
103
148
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24,
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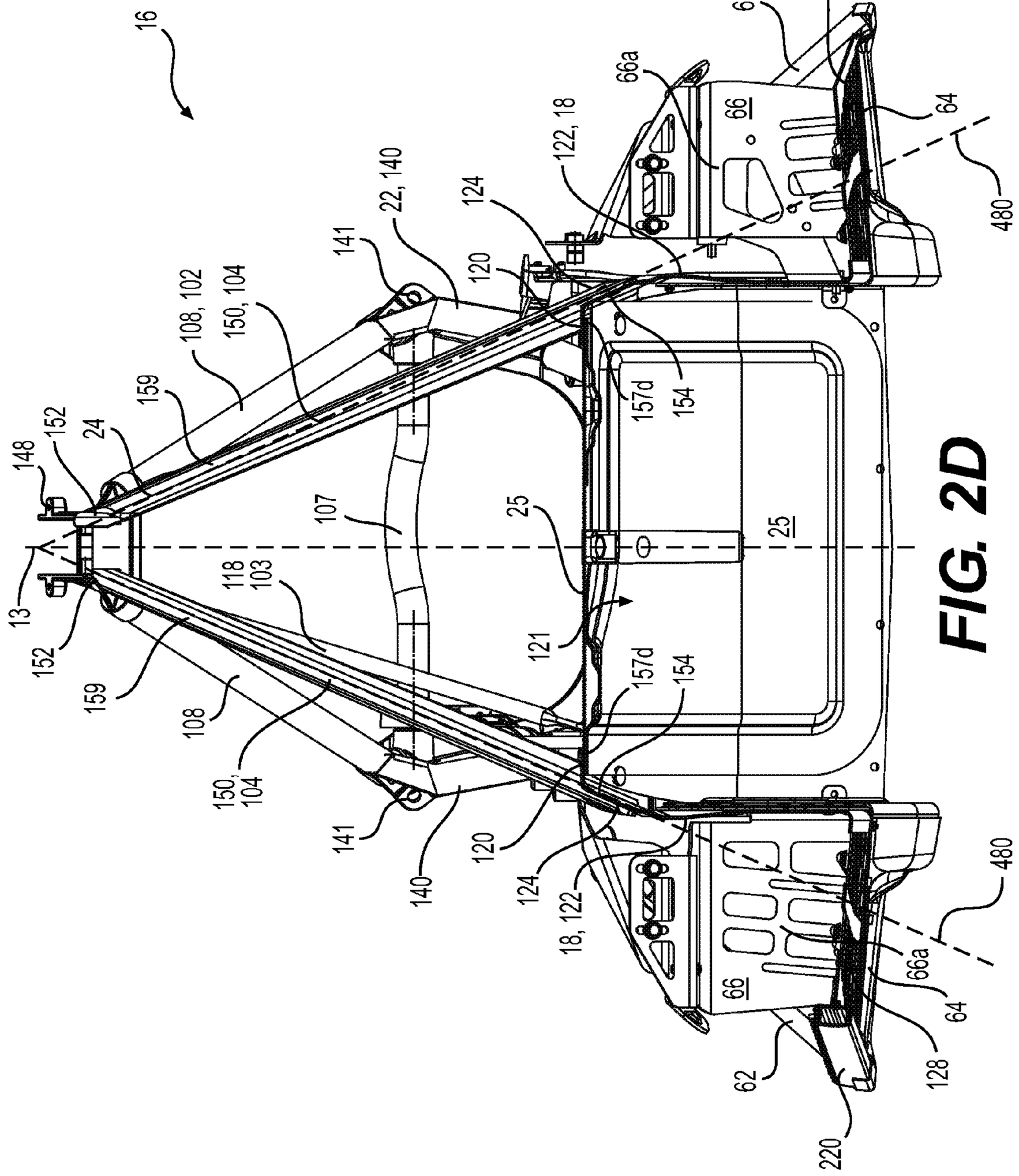
102
134
141
141
107
140
140,
22
12

FIG. 2C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108, 102
150, 104
141
22, 140
120
124
122, 18
62
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66a
64
66
480
107
118
103
25
121
157d
154
108
140
18, 122
220

FIG. 2D

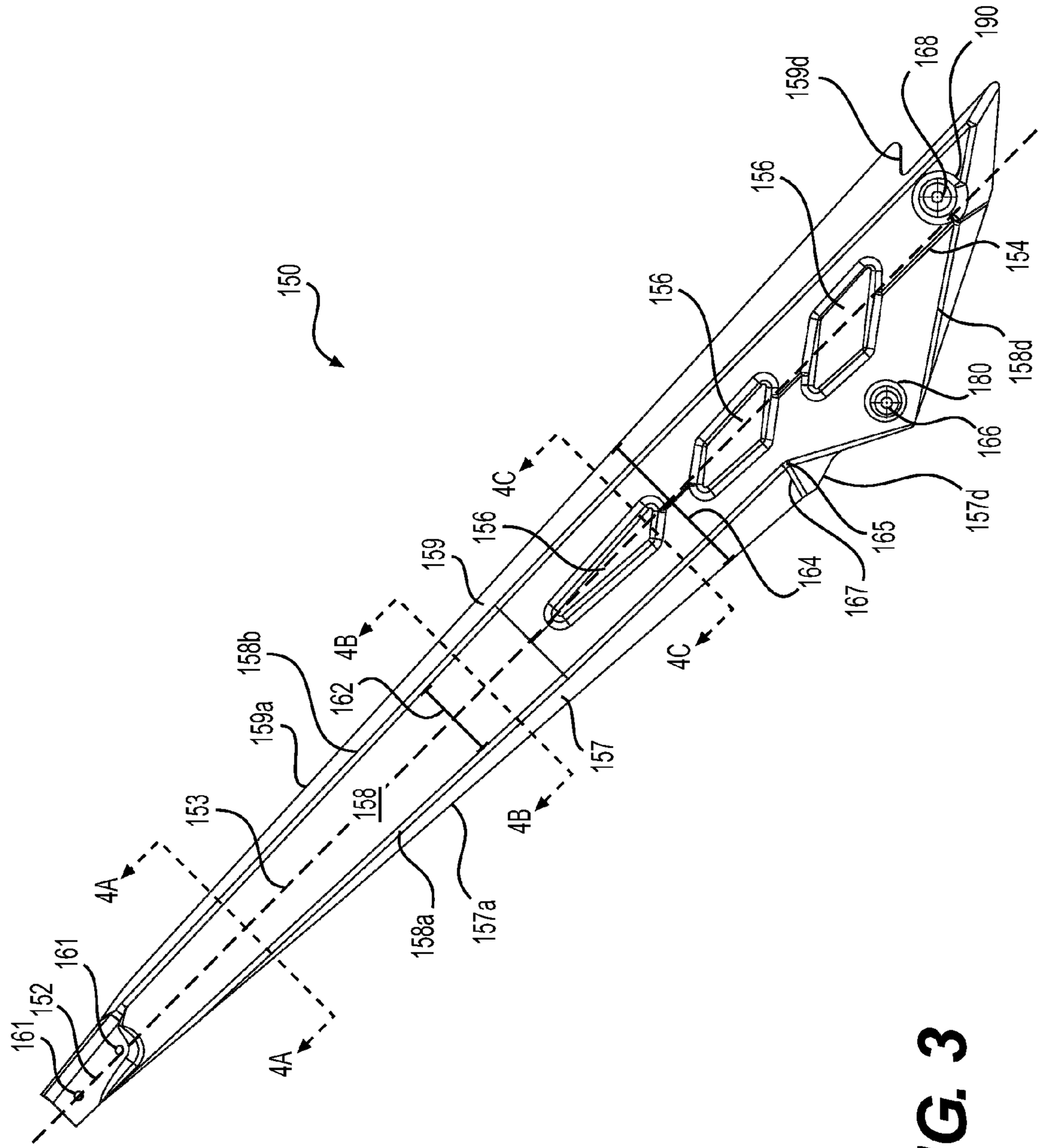

150
4A
4B
4C
152
153
154
156
157
157a
157d
158
158a
158b
158d
159
159a
159d
161
162
164
165
166
167
168
180
190

FIG. 3

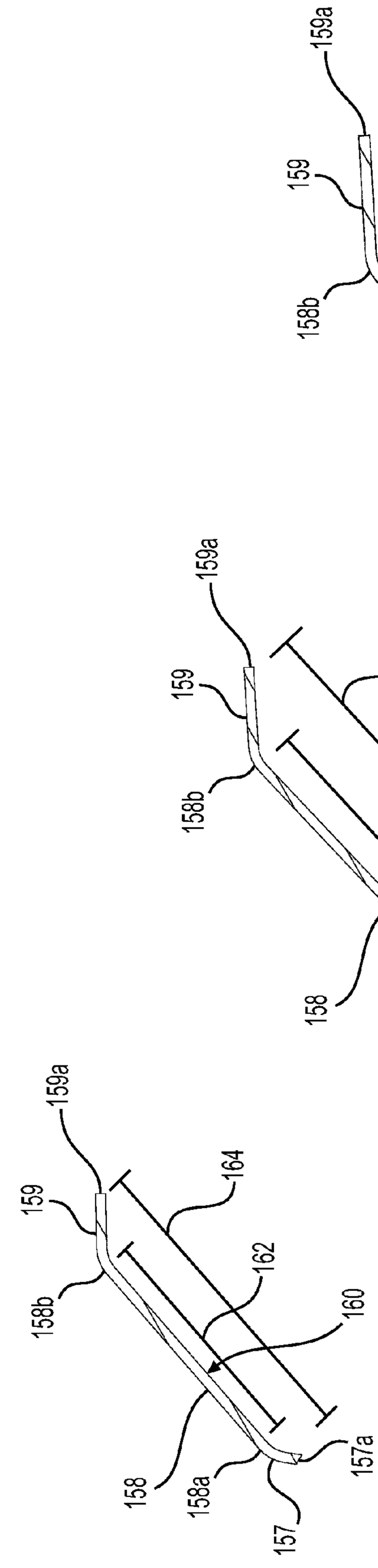


FIG. 4A

FIG. 4B

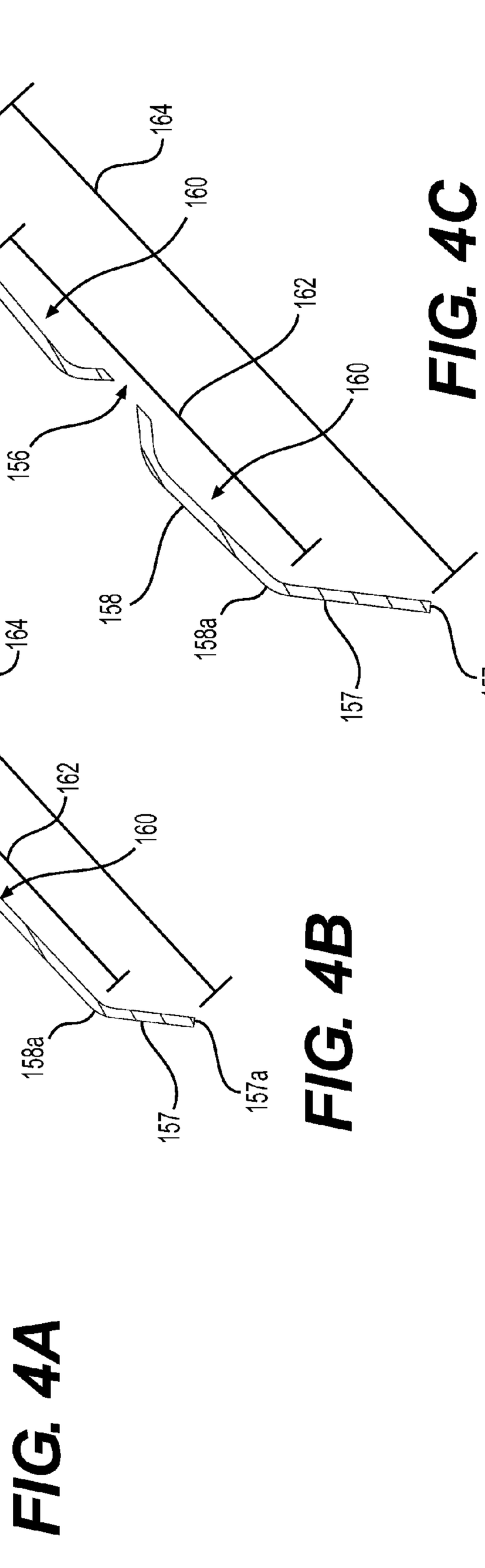


FIG. 4C

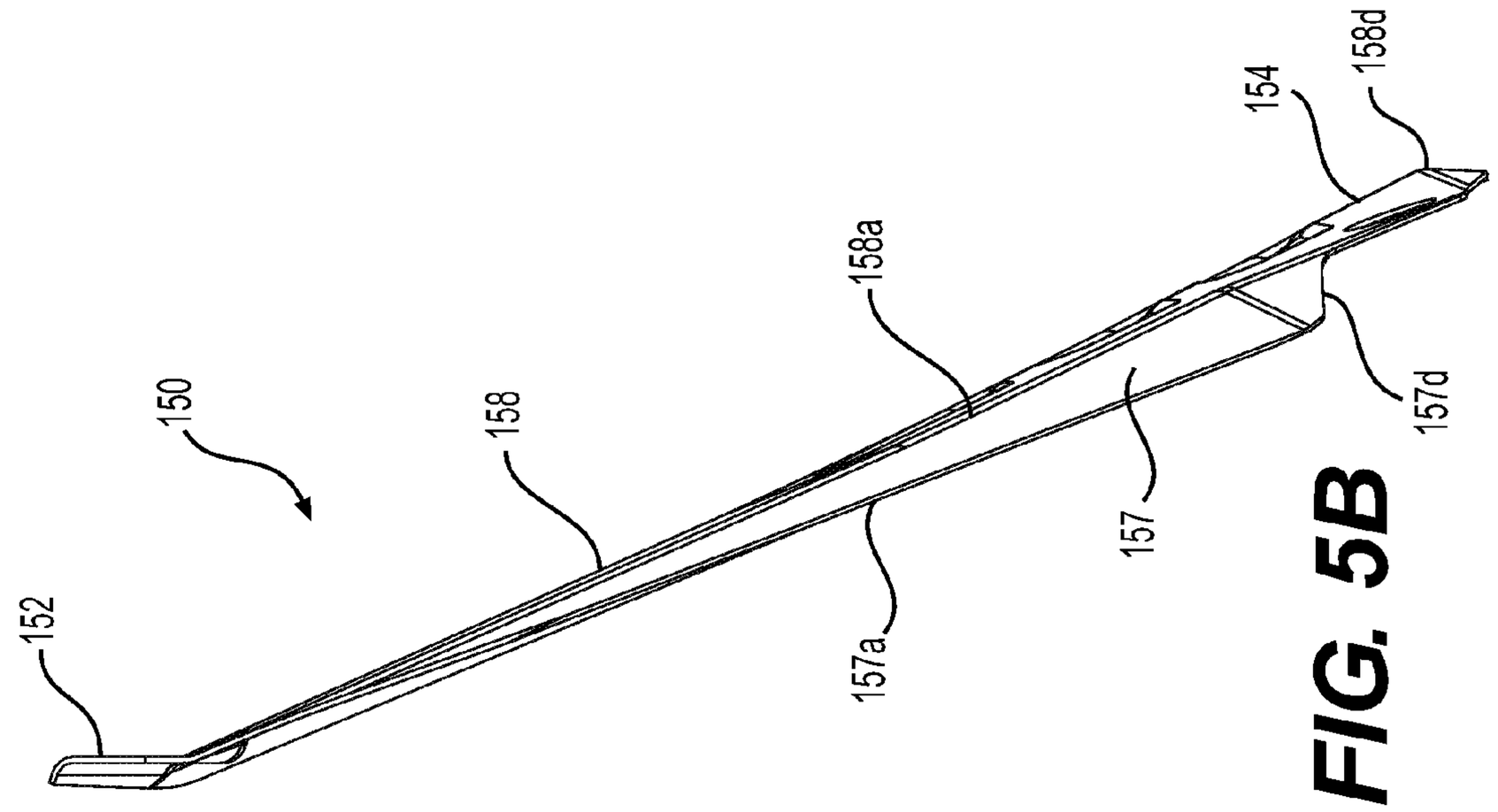

150
152
158
158a
154
158d
157
157a
157d

FIG. 5B

152
150
158b
159a
158
159
157
157d
159d
158d
154

FIG. 5A

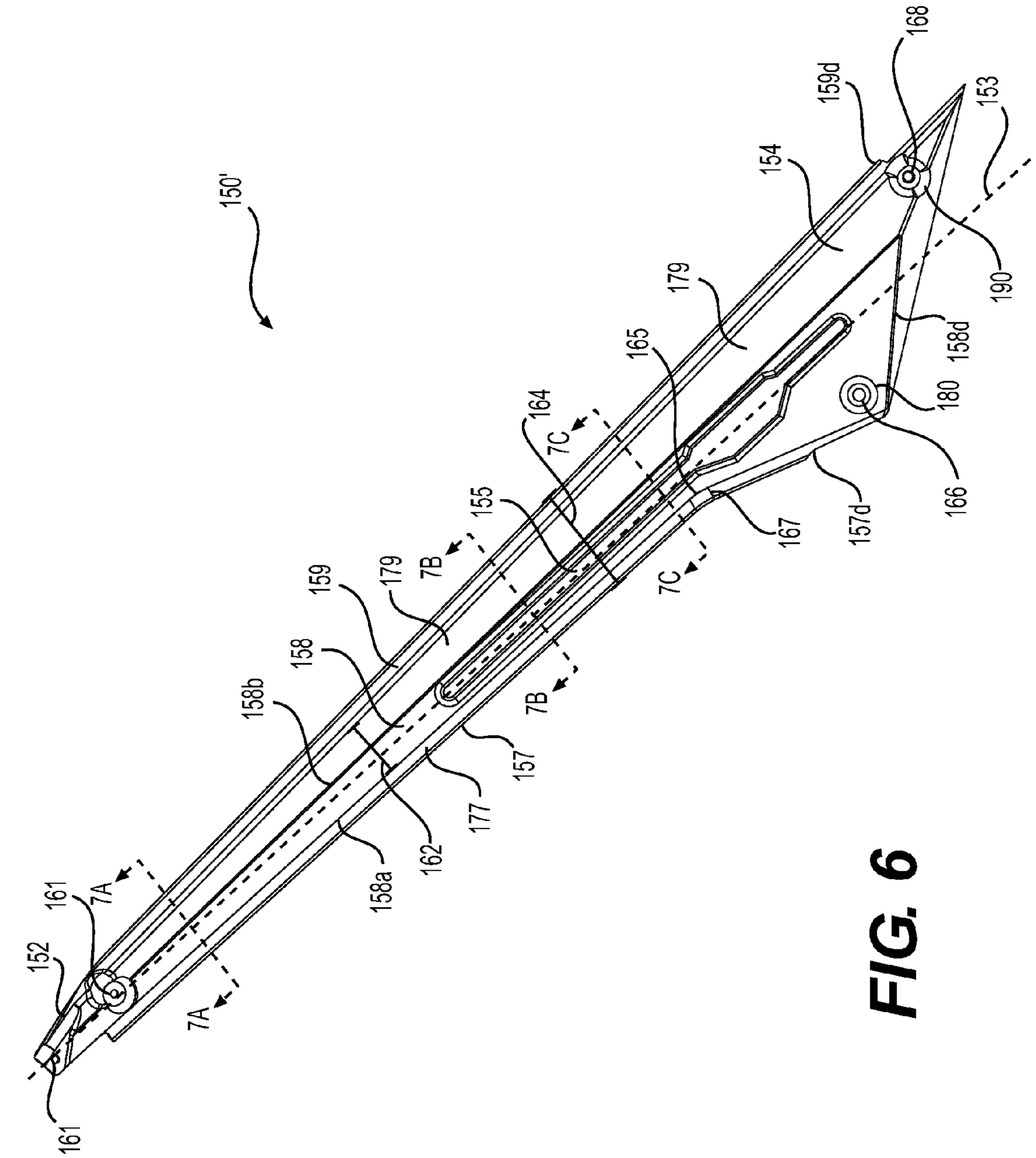

150'
168
159d
153
154
190
158d
180
166
179
165
164
7C
155
7B
159
179
158
158b
157
177
162
158a
167
157d
7C
7B
7A
161
152
7A
161

FIG. 6

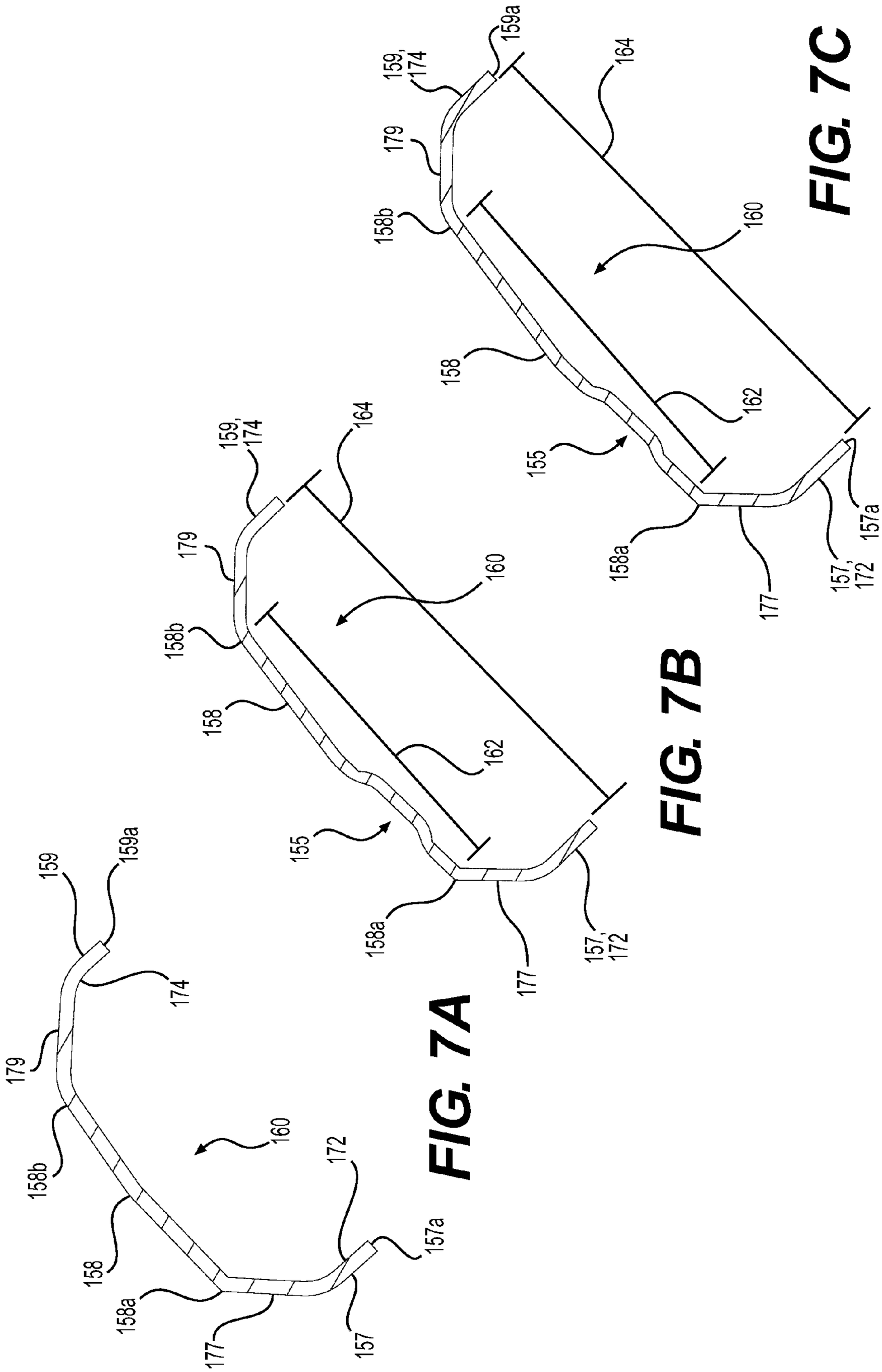
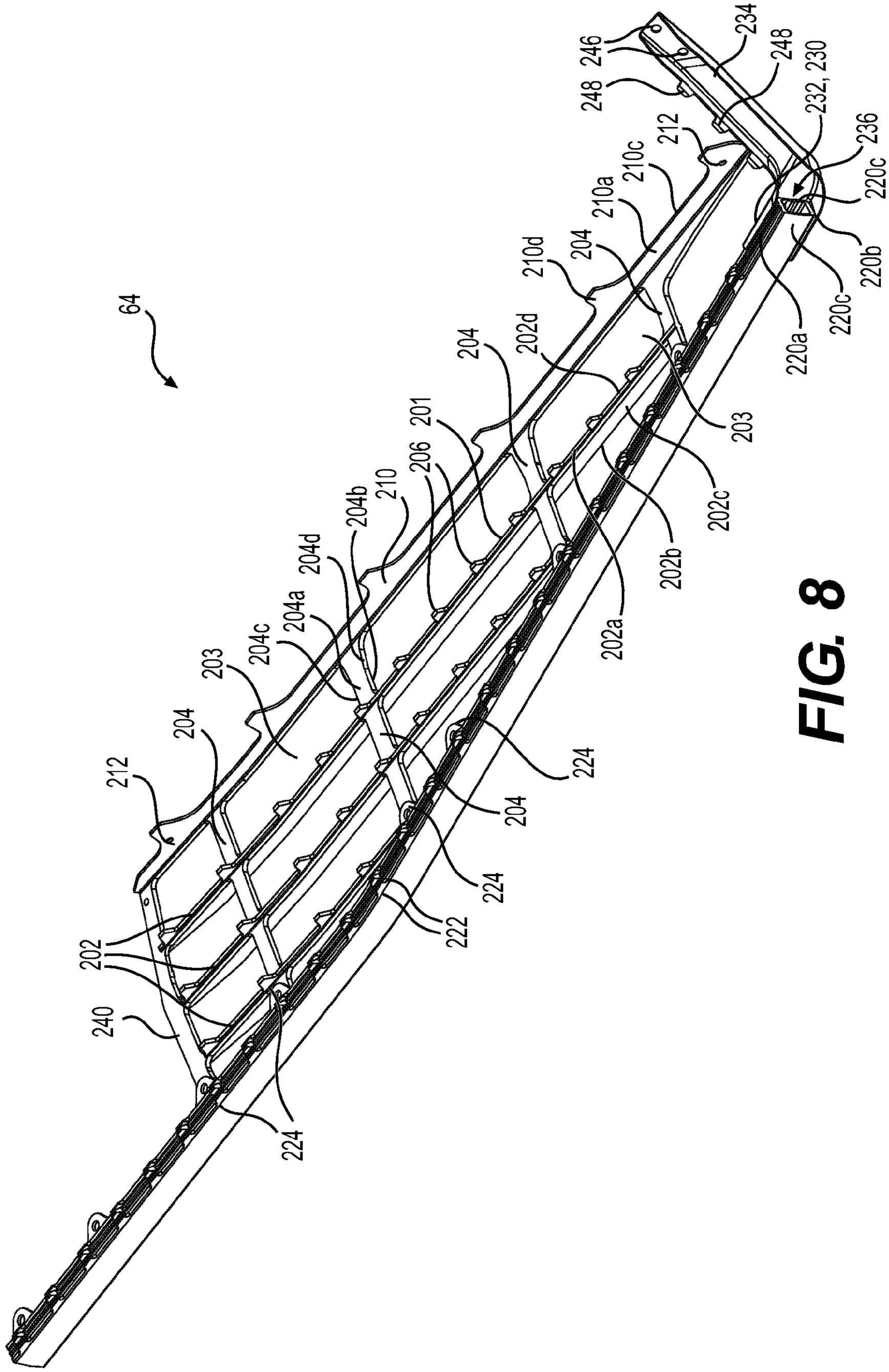


FIG. 7A

FIG. 7B

FIG. 7C


64
202
212
204
203
204c
204a
204d
204b
210
206
201
204
202d
234
246
248
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212
210c
210a
210d
204
236
220c
220b
220c
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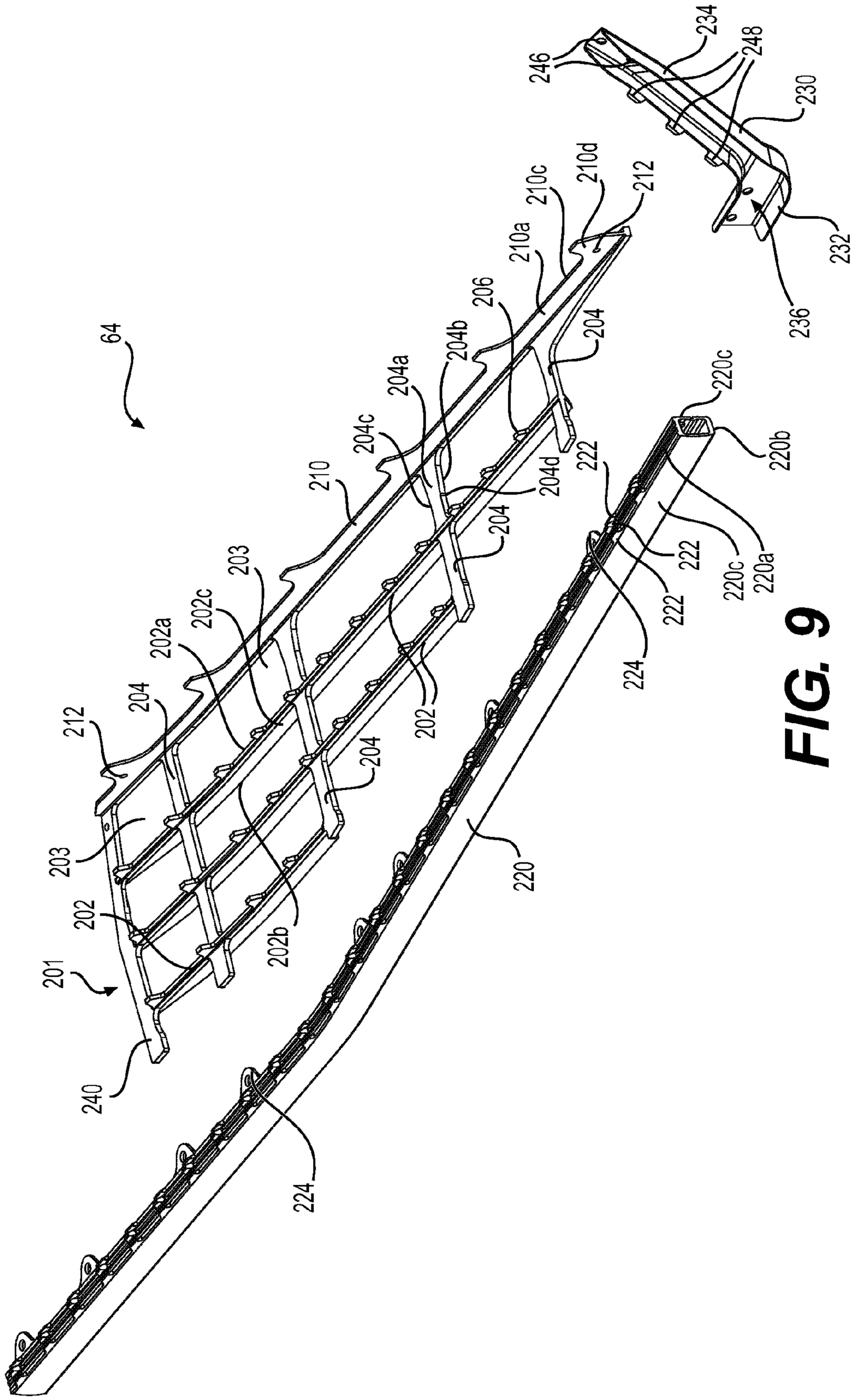
203
202c
202b
202a
224
204
224
222
240
224

FIG. 8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201
202
203
212
204
202a
202c
202b
210
204a
204c
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206
210a
210c
210d
212
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248
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236
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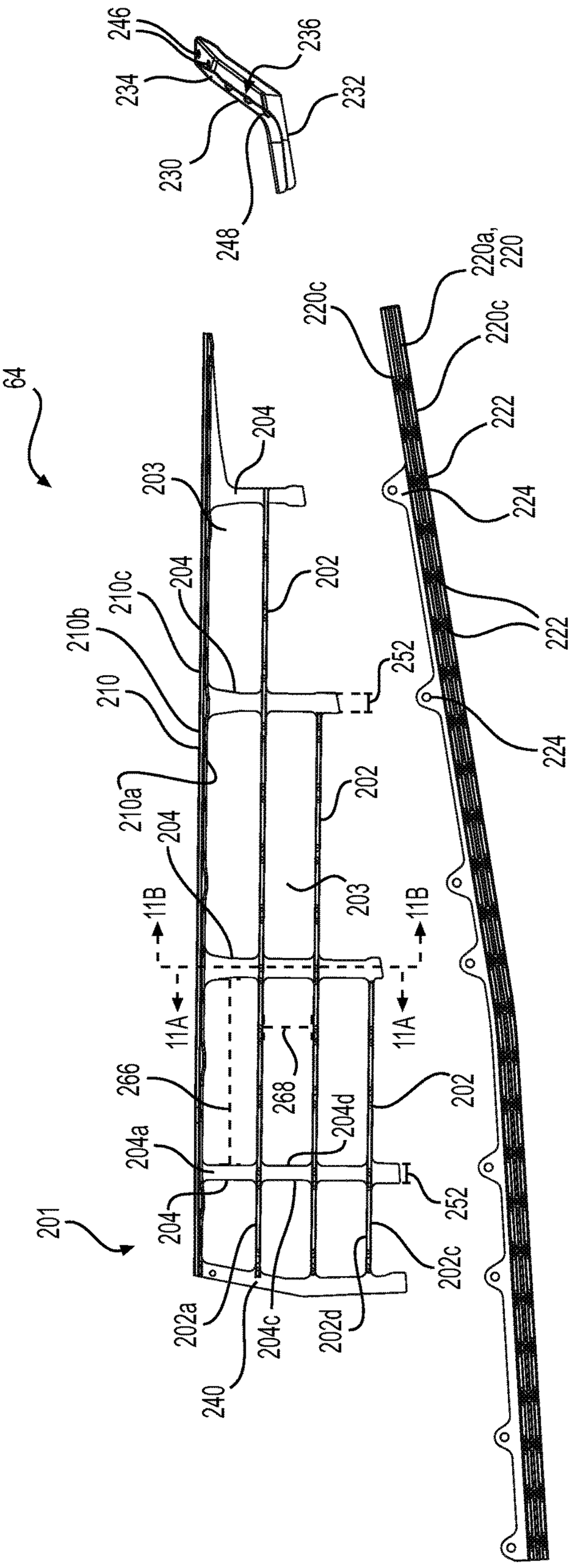
204d
222
220c
220b
220a
220
224
240

FIG. 9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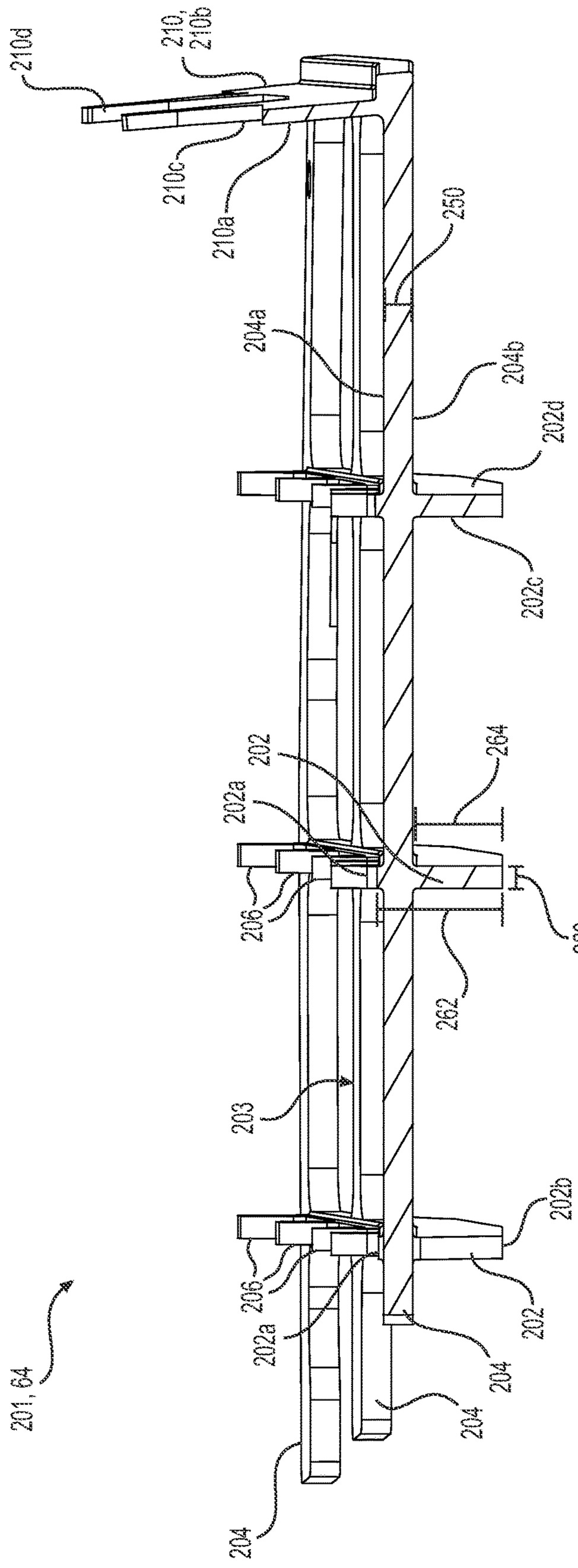
248
220a, 220
220c
220c
64
204
203
222
202
210c
204
210b
210
252
224
210a
202
204
11B
203
11A
11B
11A
266
268
204d
202
204a
201
204
252
202a
204c
202d
202c
240

FIG. 10


210d
210, 210b
210c
210a
250
204a
204b
202d
202c
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202a
264
206
260
262
203
202b
201, 64
204

FIG. 11A

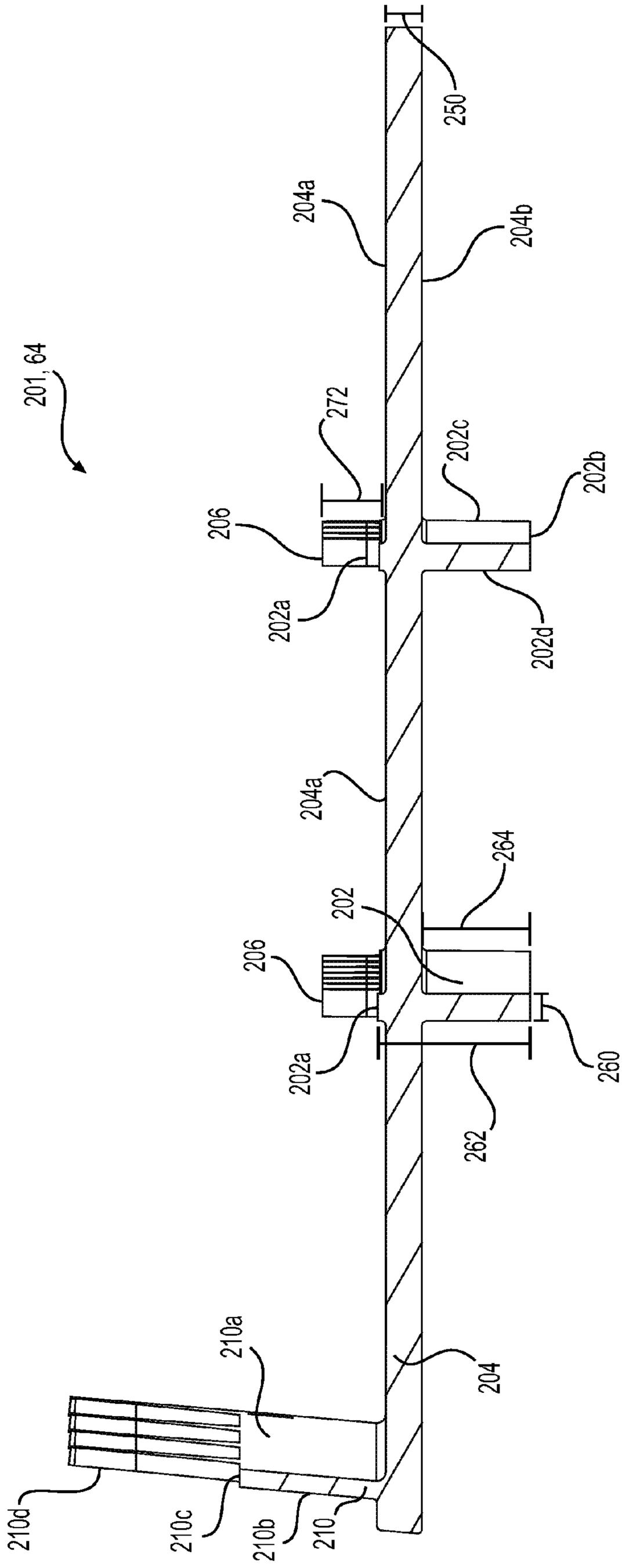
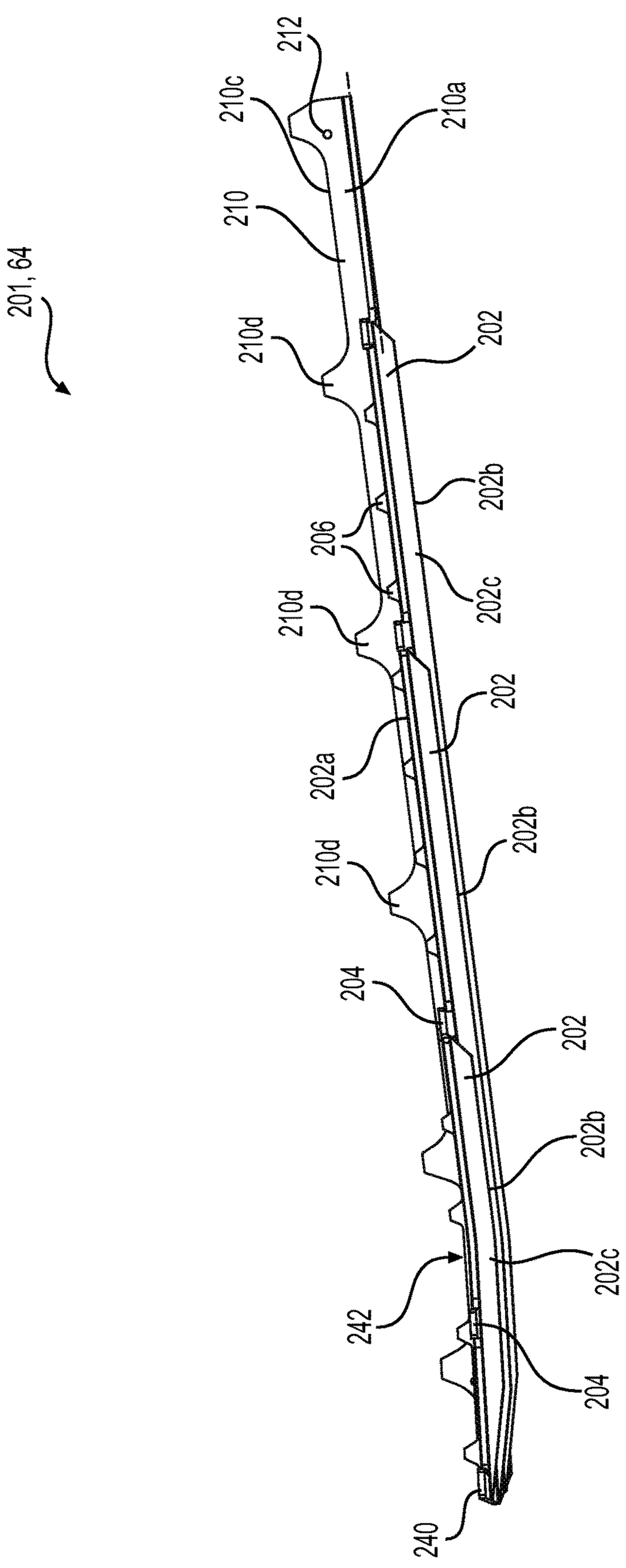

201, 64
250
204a
204b
272
206
202c
202b
202a
202d
204a
264
202
206
202a
260
262
210a
204
210d
210c
210b
210

FIG. 11B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212
210c
210a
210
210d
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202b
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202c
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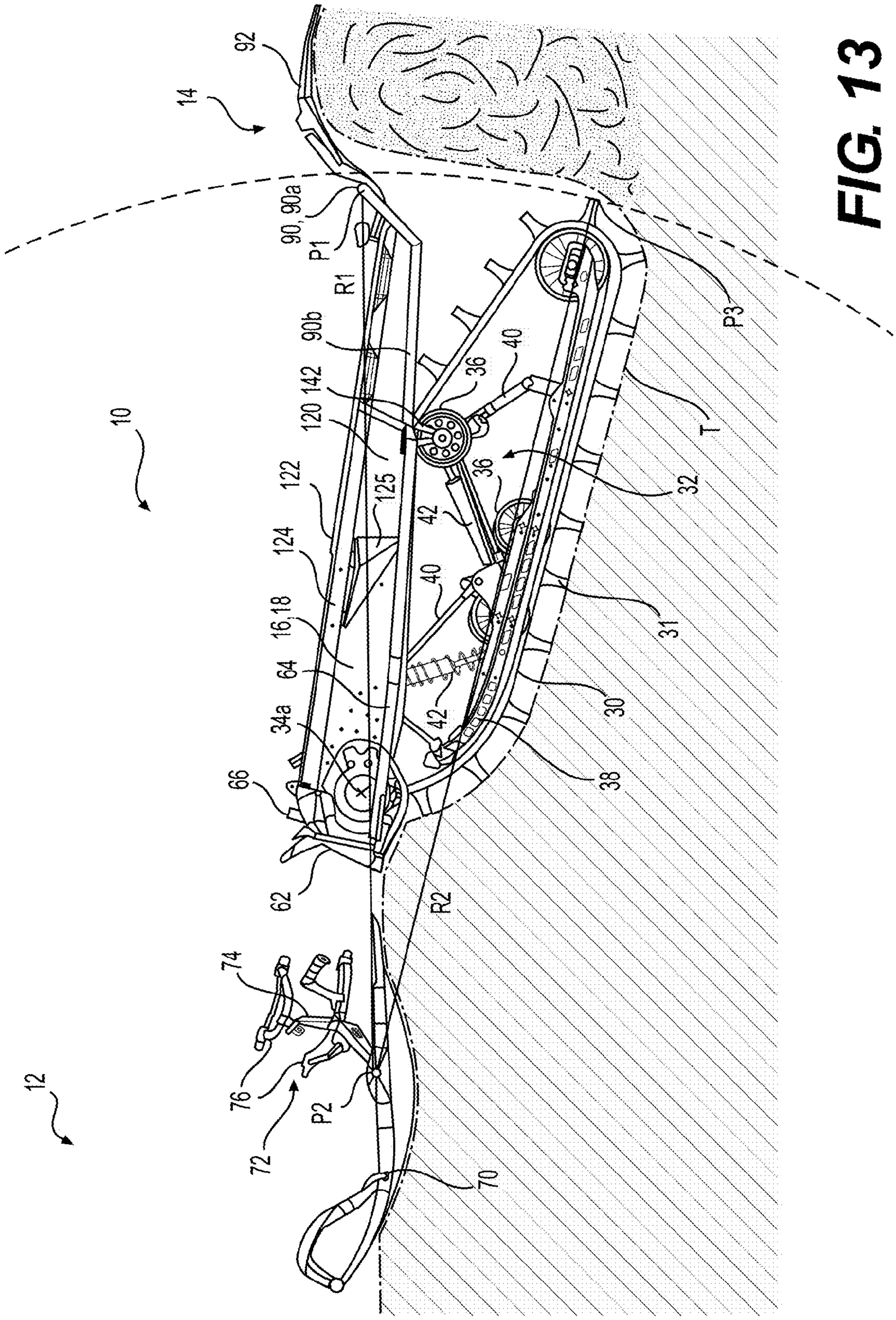
202a
210d
202b
204
202
202b
202c
242
204
240

FIG. 12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14
16,18
30
31
32
34a
36
38
40
42
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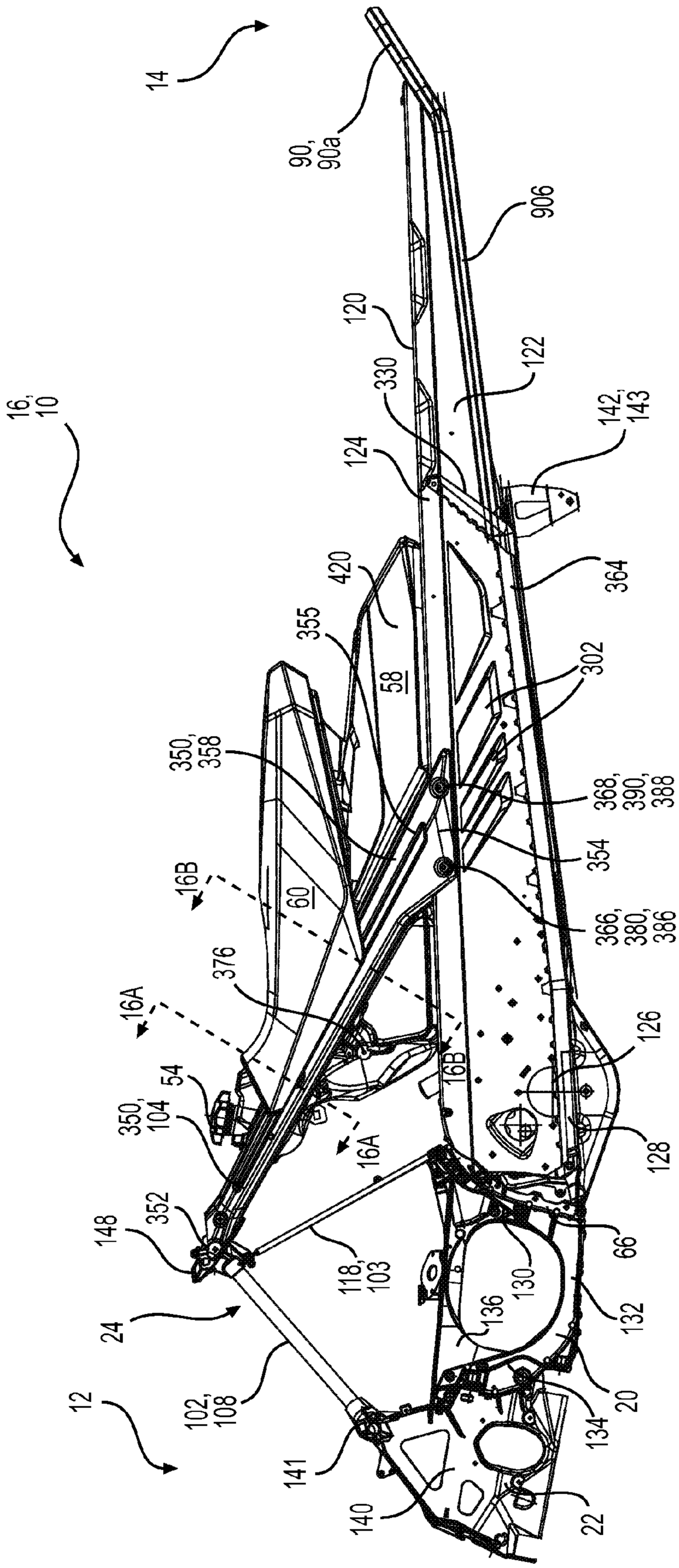
64
66
70
72
74
76
90, 90a
90b
92
120
122
124
125
142
P1
P2
P3
R1
R2
T

FIG. 13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906
120
330
122
16, 10
124
142, 143
420
364
355
58
302
350, 358
368, 390, 388
16B
60
354
366, 380, 386
376
16A
126
54
16B
350, 104
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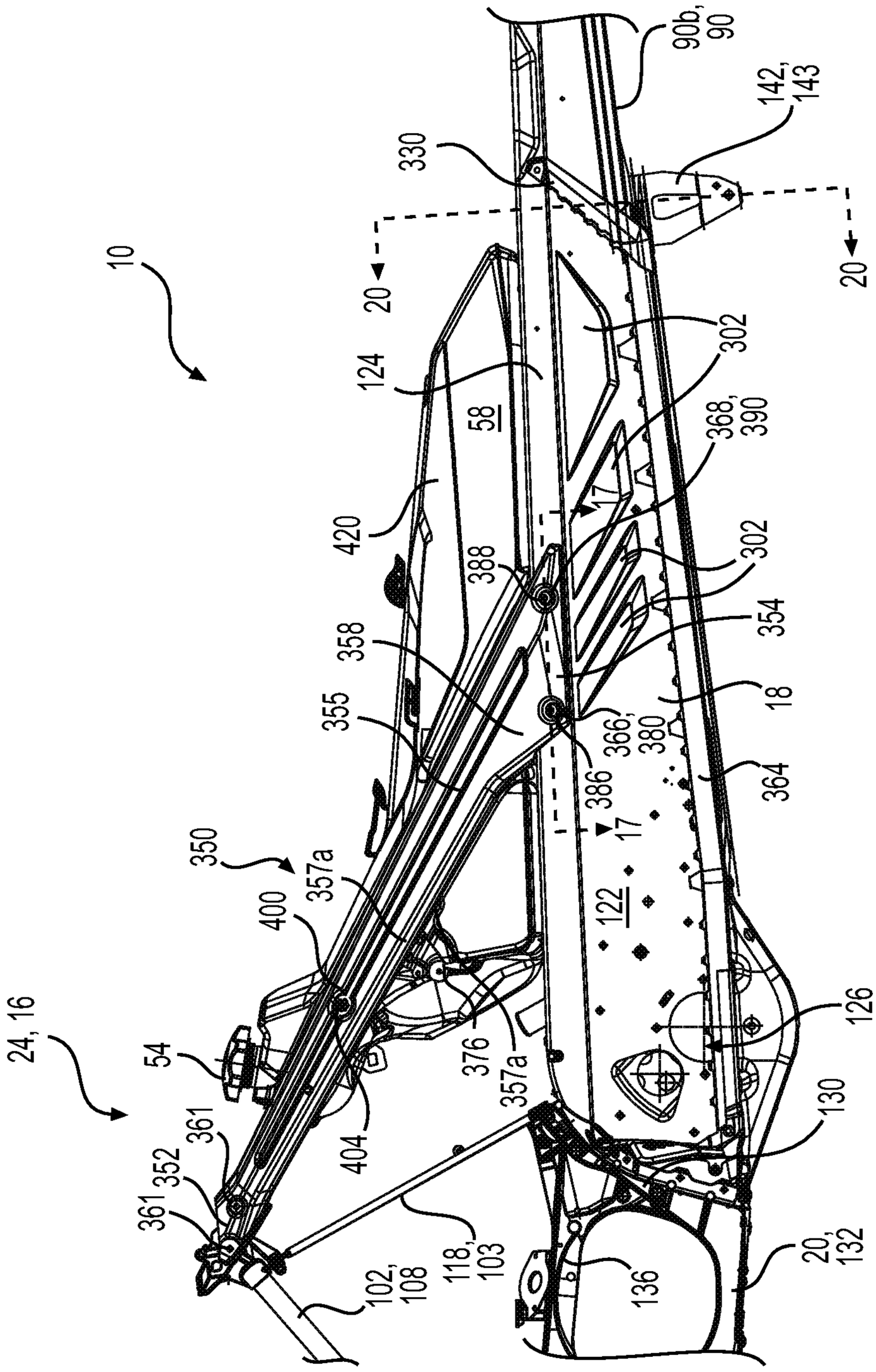
FIG. 14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124
420
388
358
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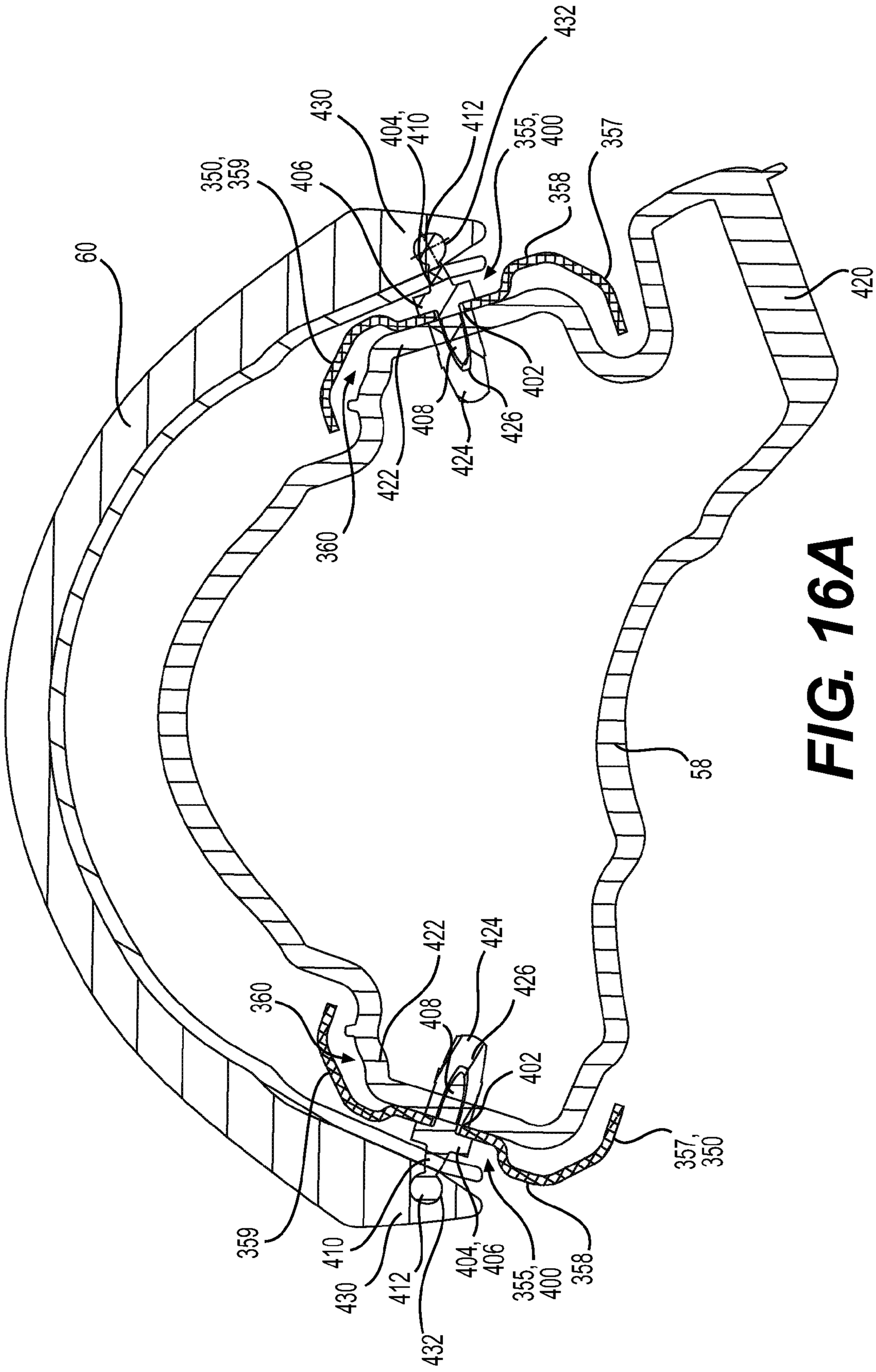
142, 143
90b, 90
17

FIG. 15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432
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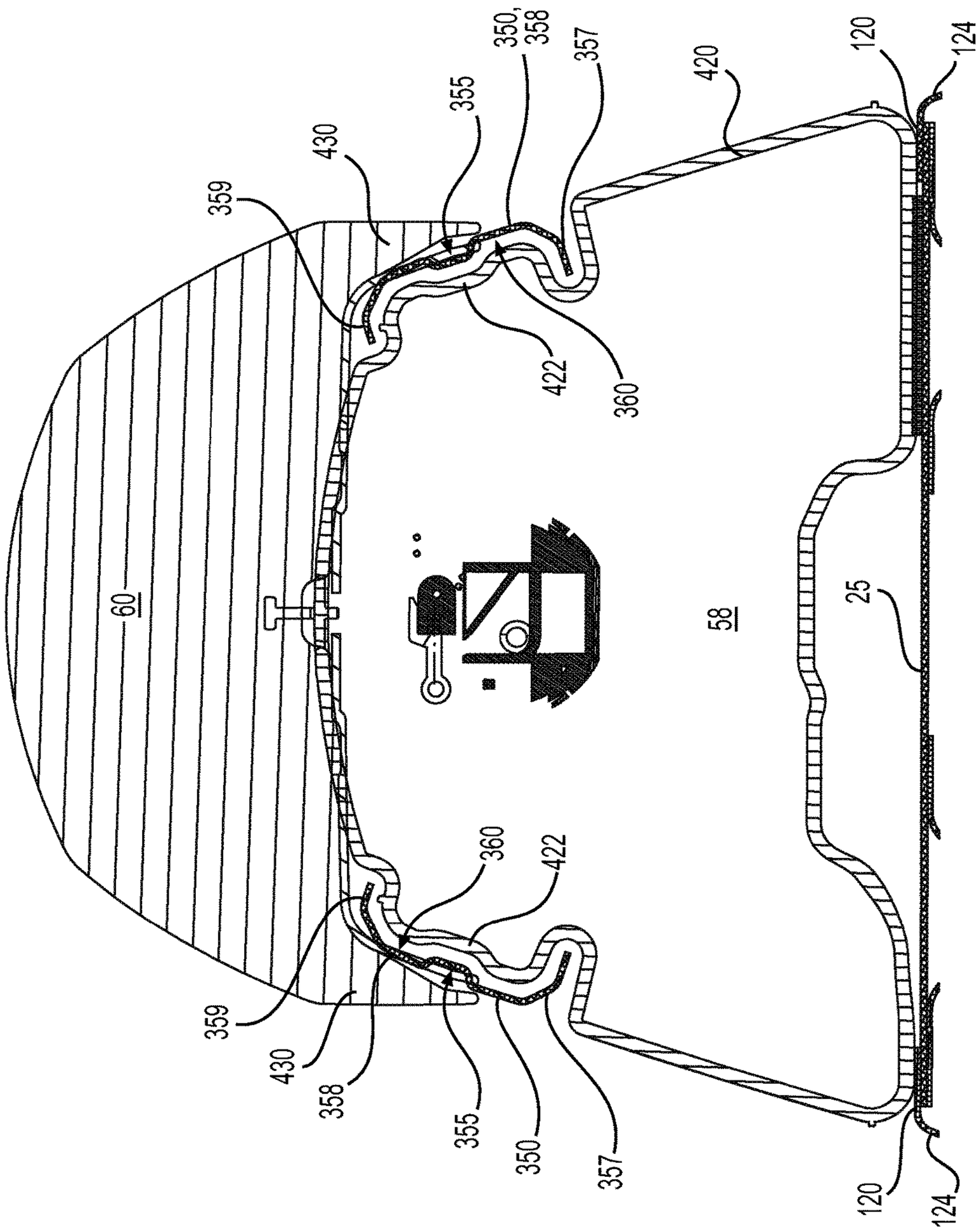
FIG. 16A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357
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124

FIG. 16B

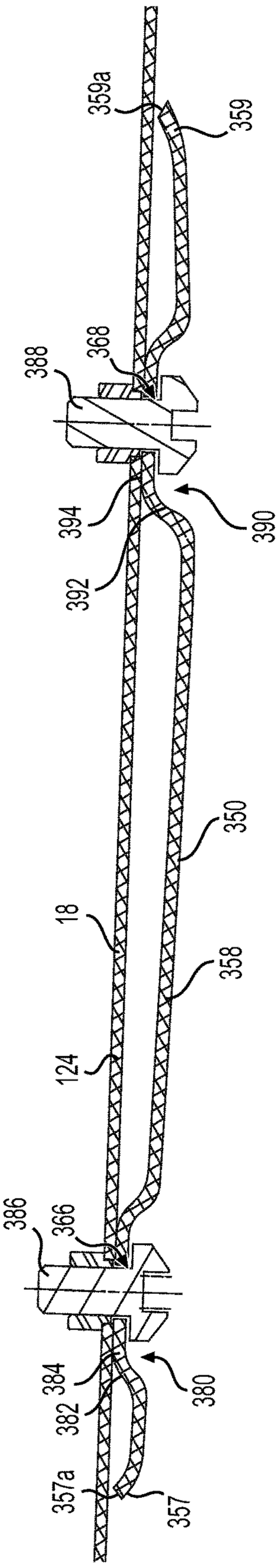
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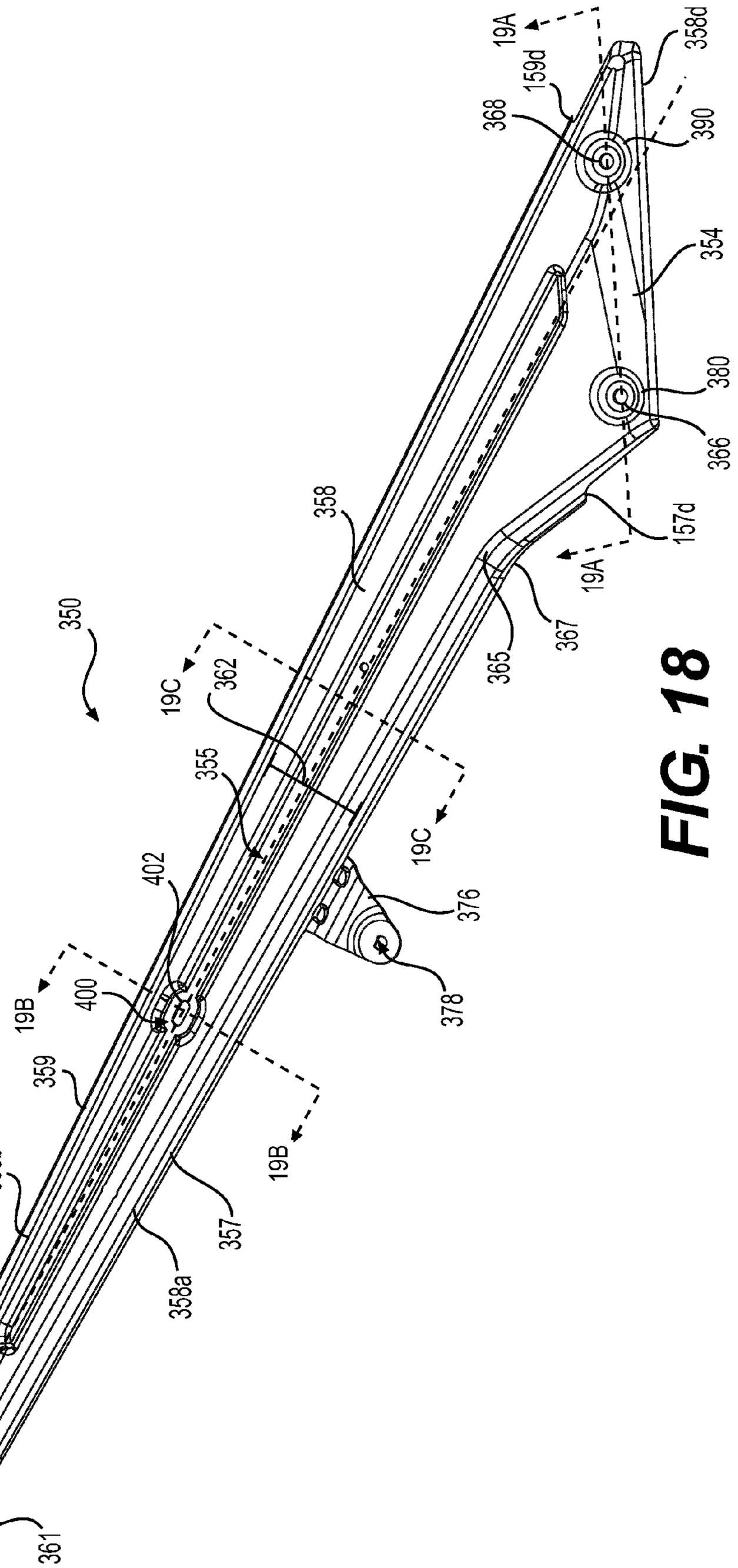
FIG. 17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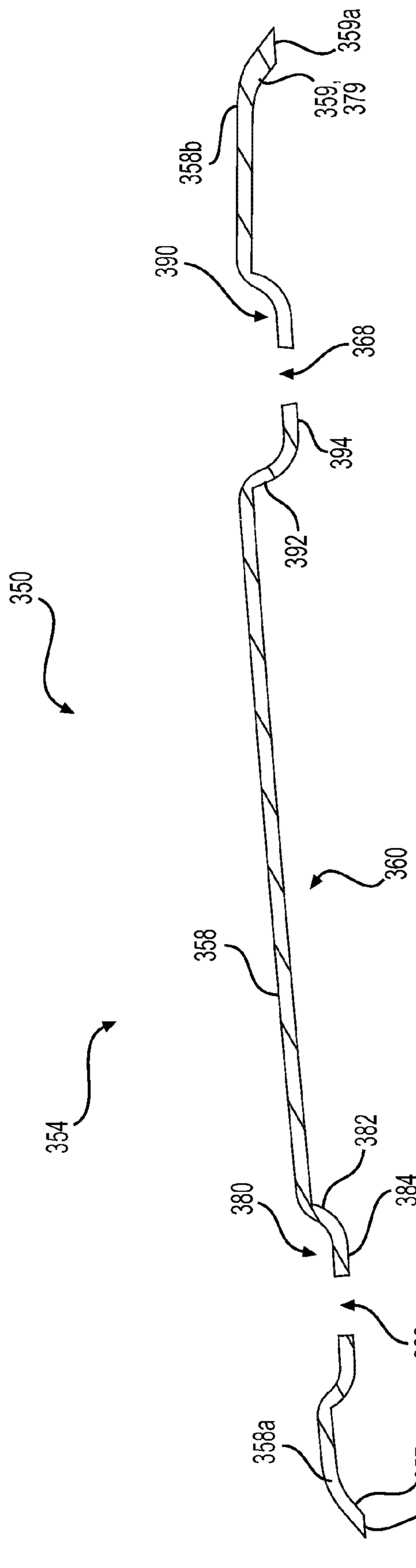
19B

FIG. 18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357a

FIG. 19A

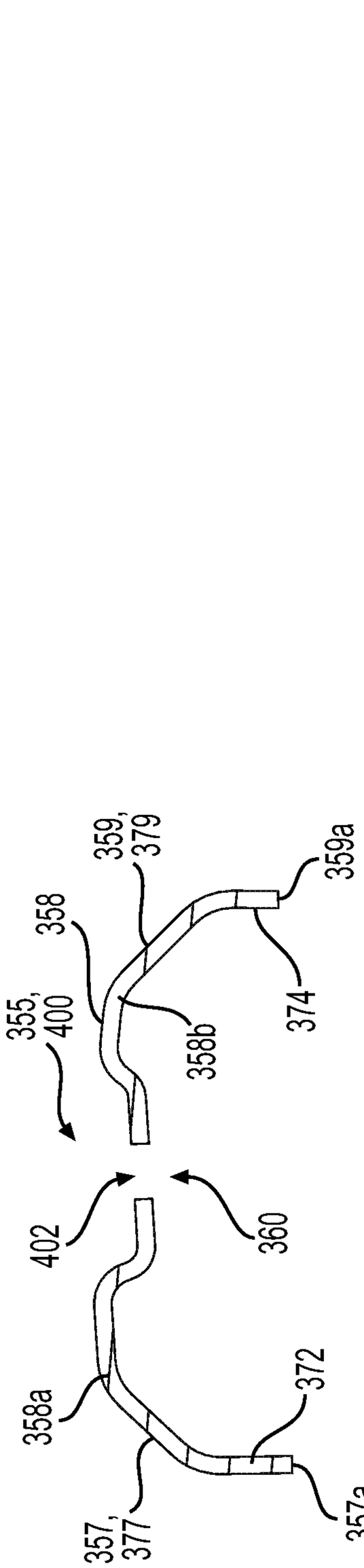

FIG. 19B

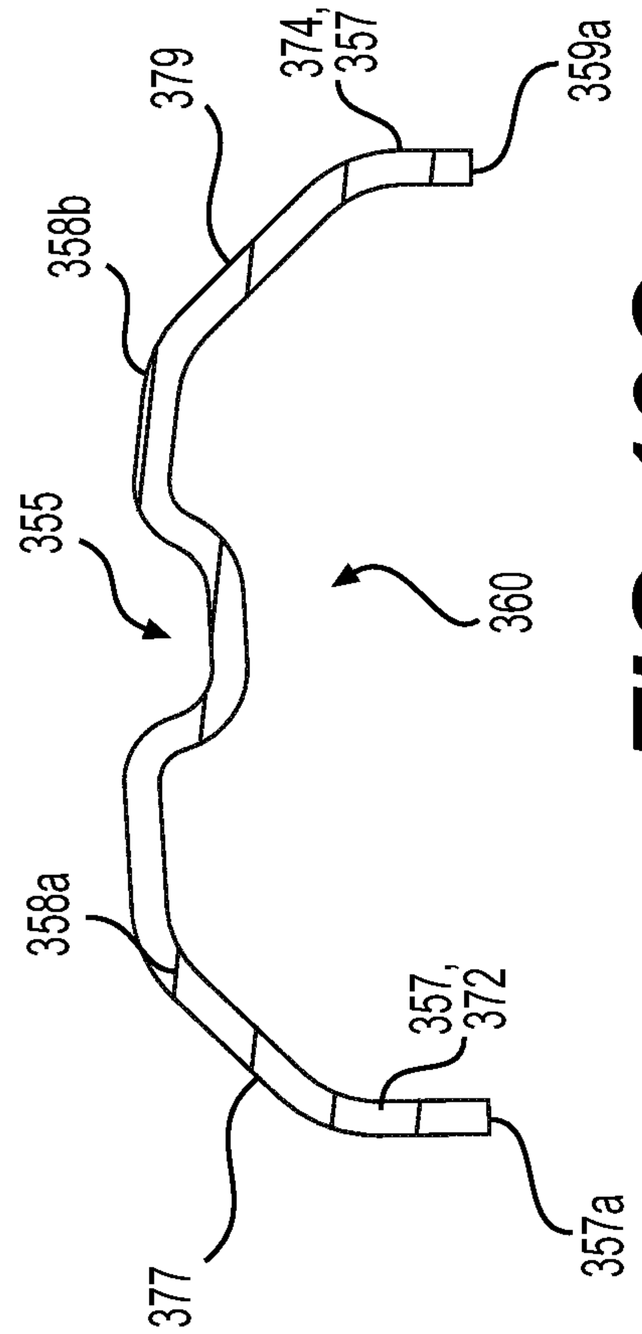

FIG. 19C

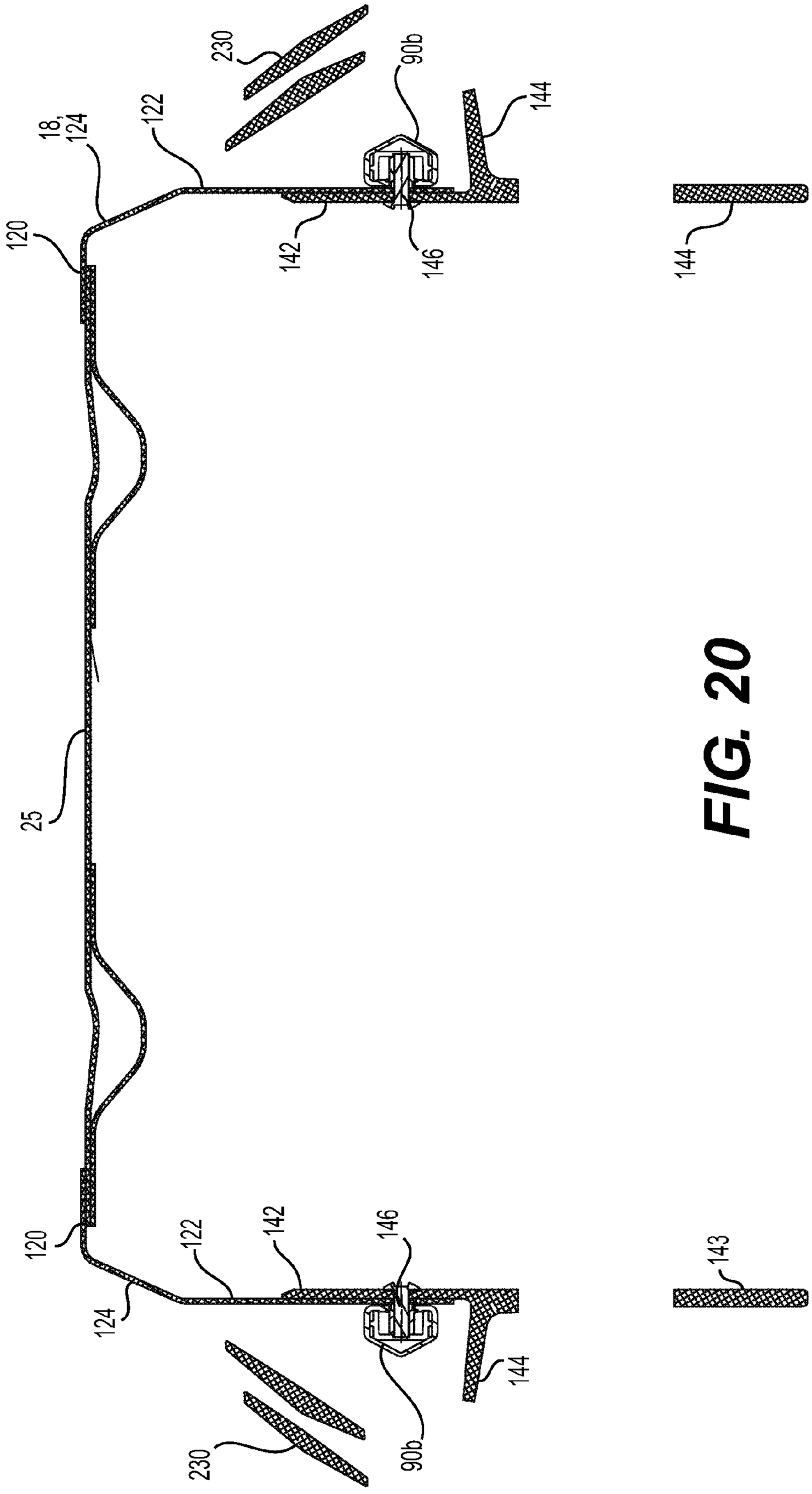
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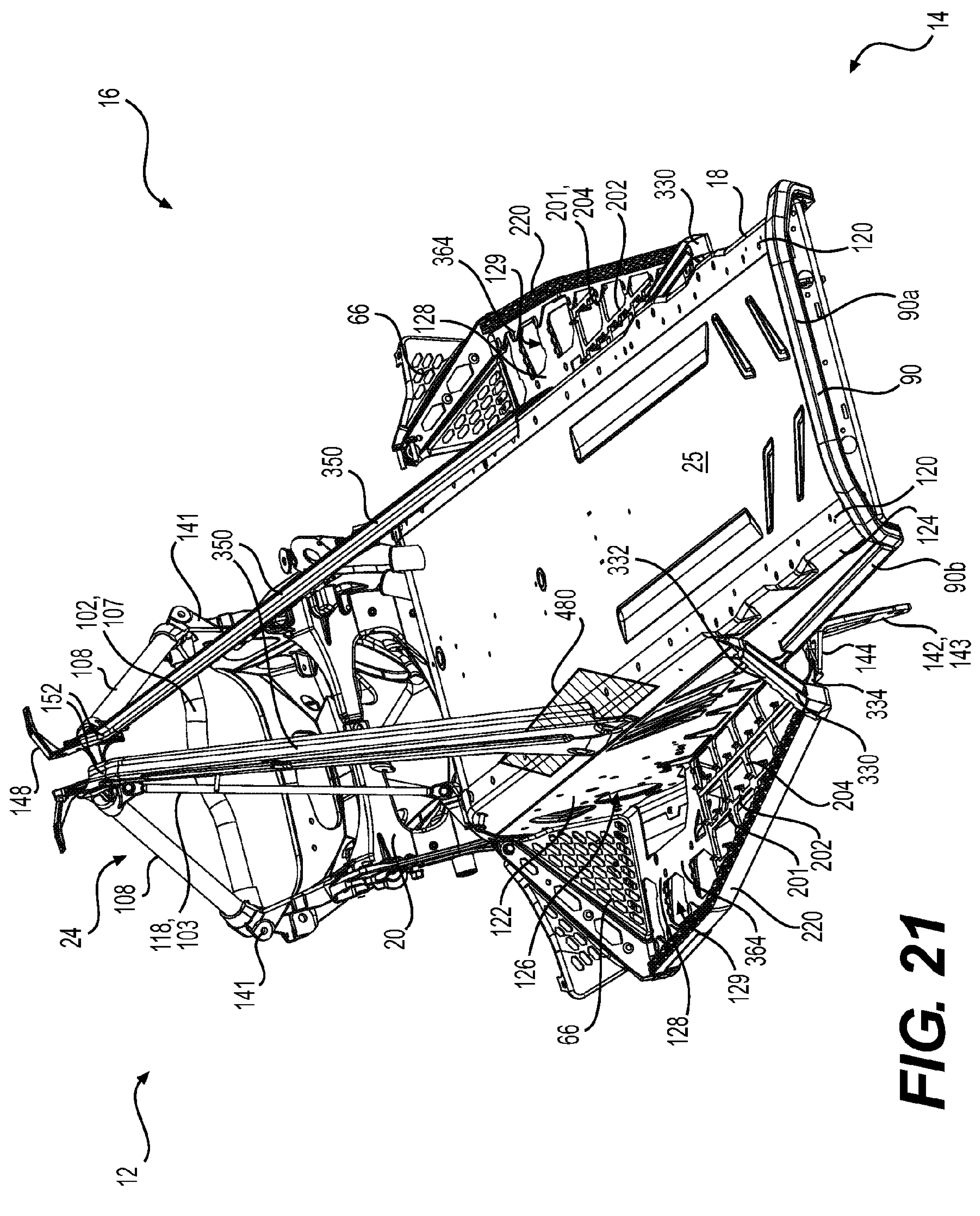
FIG. 20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118,
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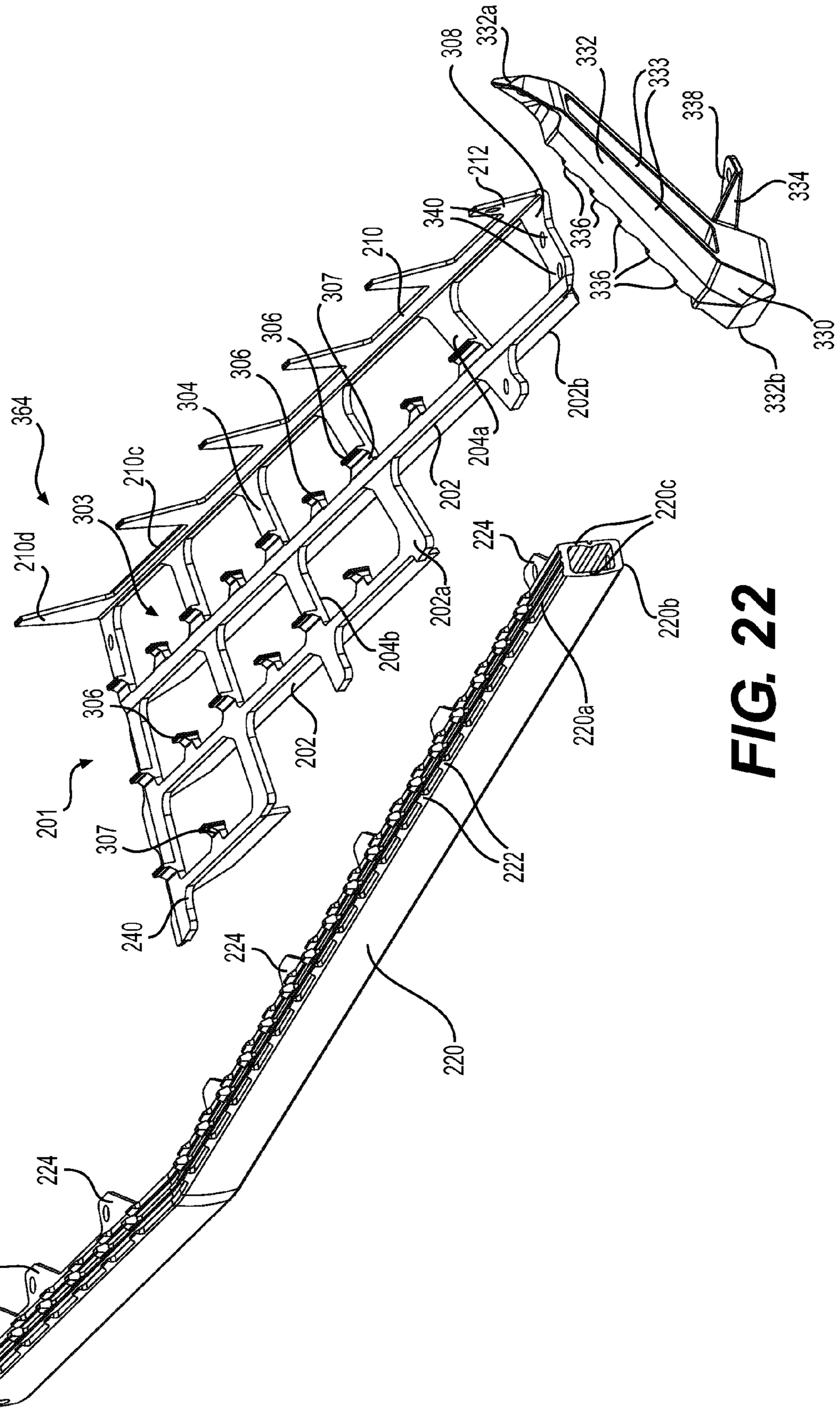
FIG. 21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306
304
364
210c
303
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204b
201
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220c
220b
220a
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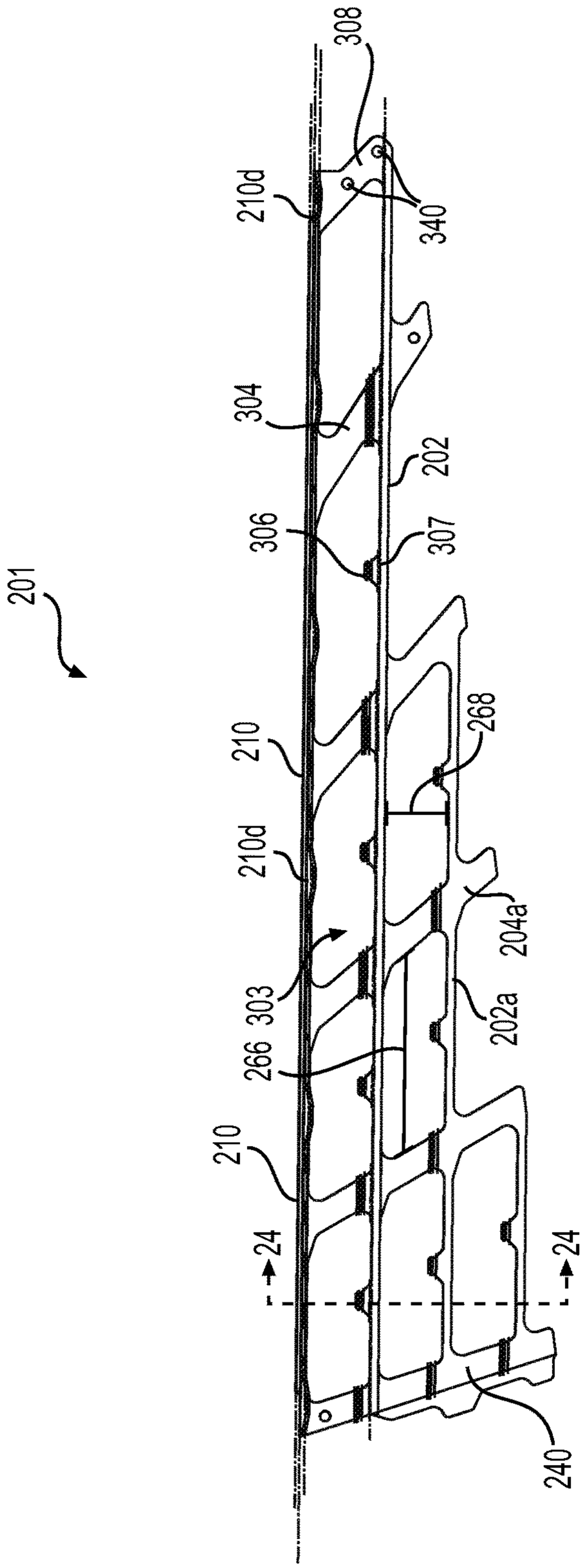
220
330
332b

FIG. 22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340
304
202
306
307
210
268
210d
303
204a
266
202a
210
24
24
240

FIG. 23

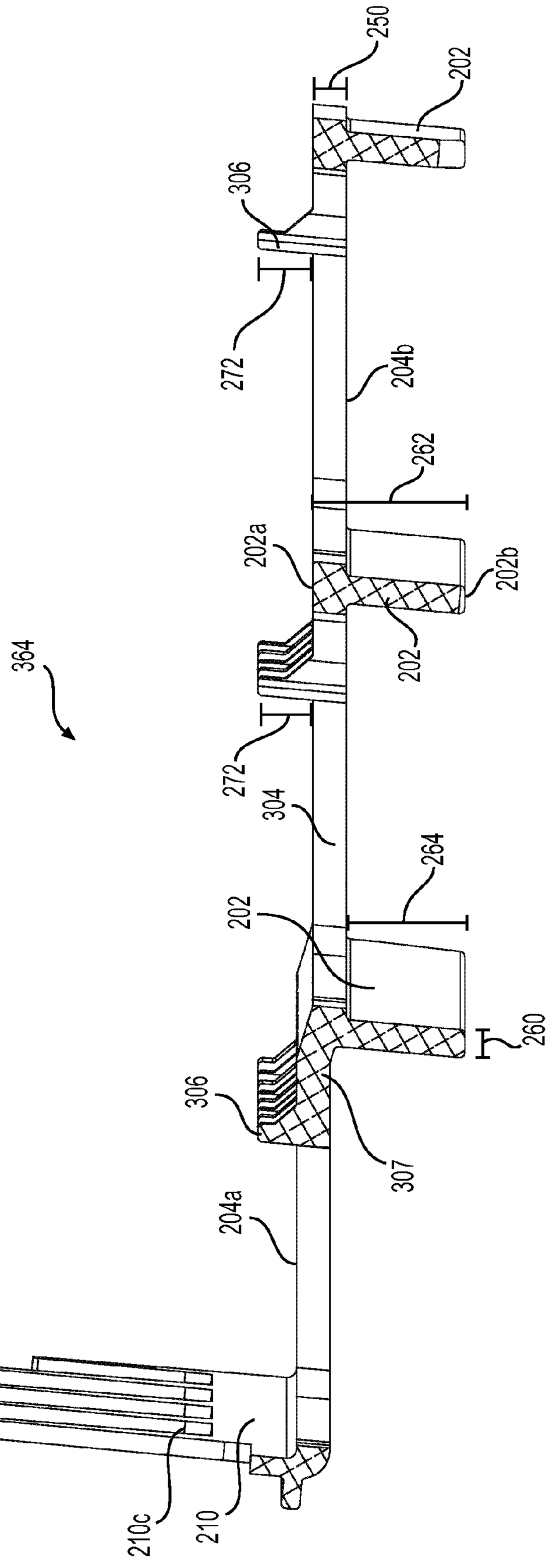
364
250
202
306
272
204b
262
202a
202b
202
272
304
264
202
260
306
307
204a
210d
210c
210

FIG. 24

SNOWMOBILE FOOTRESTS

CROSS-REFERENCE

The present application claims priority to U.S. Provisional Patent Application No. 62/019,262, filed on Jun. 30, 2014, the entirety of which is incorporated herein by reference.

TECHNICAL FIELD

The present technology relates to footrests for snowmobiles.

BACKGROUND

Snowmobiles are designed to operate on different kinds of snow-covered surfaces. A snowmobile traveling on soft snow often begins to sink in the snow until the footrests begin to contact the snow. Once the footrests begin to contact the snow, increasingly more of the weight of the snowmobile is transferred from the tracks to the footrests, as a result of which, the tracks begin to lose traction with the snow. It is therefore desirable to design the footrests to prevent or reduce this loss of traction between the tracks and the snow when travelling on soft snow-covered surfaces. It is also desirable to have the footrests be strong and easily assembled and disassembled for maintenance, repairs and replacement.

SUMMARY

One object of the present is to ameliorate at least some of the inconveniences of the prior art.

In accordance with one aspect of the present technology, there is provided a snowmobile including a frame having a longitudinally extending tunnel, at least one ski operatively connected to the frame, an endless drive track operatively connected to the frame, and a motor supported by the frame and operatively connected to the drive track for propelling the snowmobile. A straddle-type seat is disposed above the tunnel and adapted to accommodate a rider. A left footrest is connected to the tunnel and disposed on a left side thereof. A right footrest is connected to the tunnel and disposed on a right side thereof. Each of the left and right footrests includes a plurality of interconnected ribs extending generally horizontally. The plurality of ribs includes at least one first rib extending in a first direction. Each first rib includes an upper first rib surface and a lower first rib surface defining a first rib height therebetween. Each first rib includes a pair of vertical first rib surfaces extending generally in a vertical direction between the upper and lower first rib surfaces. The pair of vertical surfaces define a first rib thickness therebetween. The first rib height is greater than the first rib thickness. At least one second rib is connected to the at least one first rib. Each second rib extends in a second direction, the second direction being at an angle with respect to the first direction. The at least one first rib and the at least one second rib define at least one hole therebetween.

In some implementations, for each portion of any one of the first ribs having any one of the second ribs connected thereto, the lower first rib surface of that portion is disposed vertically lower than the one of the second ribs connected thereto.

In some implementations, for each portion of any one of the first ribs having any one of the second ribs connected thereto, the lower first rib surface is disposed vertically lower than the one of the second ribs connected thereto by a distance greater than the first rib thickness.

In some implementations, a ratio of the distance to the first rib thickness is greater than 1.5 and less than 5.5.

In some implementations, the ratio is a first ratio. Each of the at least one hole has a hole width in a direction perpendicular to the first direction. A second ratio of the hole width measured in millimeters to the first ratio is greater than 5.0 and less than 15.0.

In some implementations, each of the at least one hole has a hole width measured in a direction perpendicular to the first direction, and a ratio of the hole width to the distance is greater than 1.0 and less than 6.0. In some implementations, the first direction is a longitudinal direction of the snowmobile.

In some implementations, at a connection between any one of the second ribs and any one of the first ribs, the lower first rib surface of that first rib is disposed vertically lower than that second rib.

In some implementations, the lower first rib surface of that first rib is disposed vertically lower than the second rib by a distance greater than the first rib thickness.

In some implementations, the second direction is a lateral direction of the snowmobile.

In some implementations, each second rib includes an upper second rib surface and a lower second rib surface, the upper and lower second rib surfaces being spaced from each other in the vertical direction and defining a second rib height therebetween. A front second rib surface and a rear second rib surface extend between the upper and lower second rib surfaces and defining a second rib thickness therebetween, the second rib thickness being greater than the second rib height.

In some implementations, the second rib thickness is greater than the first rib thickness.

In some implementations, a first distance between two consecutive ones of the at least one first rib is smaller than a second distance between two consecutive ones of the at least one second rib, the first distance being measured in a direction perpendicular to the first direction, the second distance being measured in a direction perpendicular to the second direction.

In some implementations, the at least one first rib is integrally formed with the at least one second rib.

In some implementations, the at least one first rib and the at least one second rib are formed at least in part by extrusion.

In some implementations, the extrusion is in the first direction.

In some implementations, each of the left and right footrests further comprises a plurality of teeth, each tooth of the plurality of teeth projecting upwardly from at least one of: at least one of the first ribs and at least one of the second ribs.

In some implementations, each of the left and right footrests is removably connected to the tunnel.

In some implementations, each of the left and right footrests further comprises a mounting flange extending along a laterally inner edge thereof, the mounting flange being removably connected to the tunnel.

In some implementations, each of the left and right footrests further includes a front tunnel extension extending generally horizontally and laterally outwardly from the tunnel and being integrally formed therewith, the plurality of interconnected ribs being disposed rearward of the front tunnel extension. A mounting bracket is connected to a

laterally outer edge of the plurality of ribs and removably connected to the front tunnel extension.

In some implementations, the tunnel comprises a left side surface and a right side surface. The plurality of interconnected ribs of the left footrest is disposed leftwardly of the left side surface, and the plurality of interconnected ribs of the right footrest is disposed rightwardly of the right side surface. Each of the left and right footrests further includes an inner mounting flange formed along a laterally inner edge of the corresponding plurality of interconnected ribs and to the corresponding one of the left and right side surfaces of the tunnel. An outer mounting bracket is connected to a laterally outer edge of the corresponding plurality of interconnected ribs and to a laterally outer edge of the corresponding front tunnel extension. A rear mounting bracket is connected to the outer mounting bracket and to the corresponding one of the left and right side surfaces of the tunnel.

In some implementations, when viewed from a top of the snowmobile, each of the left and right footrests tapers in a rearward direction.

In some implementations, the first direction is a generally longitudinal direction of the snowmobile. The at least one first rib includes a laterally outer first rib and a laterally inner first rib disposed laterally inwardly of the laterally outer first rib. The laterally inner first rib extends farther rearward than the laterally outer first rib.

In accordance with another aspect of the present technology, there is provided a footrest is adapted to be disposed on a side of a longitudinally extending tunnel of a snowmobile. The footrest includes a plurality of interconnected ribs. The plurality of interconnected ribs includes at least one first rib extending in a first direction. Each first rib has an upper first rib surface and a lower first rib surface defining a first rib height therebetween. Each first rib has a pair of vertical first rib surfaces extending generally in a vertical direction between the upper and lower first rib surfaces. The pair of vertical surfaces define a first rib thickness therebetween. The first rib height is greater than the first rib thickness. At least one second rib is connected to the at least one first rib. Each second rib extends in a second direction, the second direction being at an angle with respect to the first direction. The at least one first rib and the at least one second rib define at least one hole therebetween.

For purposes of this application, terms related to spatial orientation such as forwardly, rearwardly, upwardly, downwardly, left, and right, are as they would normally be understood by a driver of the vehicle sitting thereon in a normal riding position. Terms related to spatial orientation when describing or referring to components or sub-assemblies of the vehicle, separately from the vehicle, such as the ice scratcher for example, should be understood as they would be understood when these components or sub-assemblies are mounted to the vehicle.

Implementations of the present technology each have at least one of the above-mentioned aspects, but do not necessarily have all of them. It should be understood that some aspects of the present technology that have resulted from attempting to attain the above-mentioned object may not satisfy this object and/or may satisfy other objects not specifically recited herein.

Additional and/or alternative features, aspects, and advantages of implementations of the present technology will become apparent from the following description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present technology, as well as other aspects and further features thereof, reference is made to the following description which is to be used in conjunction with the accompanying drawings, where:

FIG. **1** is a partially cut-away left side elevation view of a portion of a snowmobile;

FIG. **2**A is a left side elevation view of a portion of the snowmobile of FIG. **1**;

FIG. **2**B is a perspective view, taken from a rear, left side, of the snowmobile portion of FIG. **2**A;

FIG. **2**C is a top plan view of the snowmobile portion of FIG. **2**A;

FIG. **2**D is a cross-sectional view taken along the line **2**D-**2**D of FIG. **2**C;

FIG. **3** is a left side elevation view of a left leg of an upper rear support of the frame of the snowmobile of FIG. **1**;

FIG. **4**A is a line section taken along the line **4**A-**4**A of FIG. **3**;

FIG. **4**B is a line section taken along the line **4**B-**4**B of FIG. **3**;

FIG. **4**C is a line section taken along the line **4**C-**4**C of FIG. **3**;

FIG. **5**A is a rear elevation view of the left leg of FIG. **3**;

FIG. **5**B is a front elevation view of the left leg of FIG. **3**;

FIG. **6** is a left side elevation view of a left leg according to another implementation;

FIG. **7**A is a line section taken along the line **7**A-**7**A of FIG. **6**;

FIG. **7**B is a line section taken along the line **7**B-**7**B of FIG. **6**;

FIG. **7**C is a line section taken along the line **7**C-**7**C of FIG. **6**;

FIG. **8** is a perspective view, taken from a rear, left side, of a left footrest of the snowmobile of FIGS. **2**A to **2**D;

FIG. **9** is an exploded perspective view, taken from a rear, left side, of the left footrest of FIG. **8**;

FIG. **10** is an exploded top plan view of the left footrest of FIG. **8**;

FIG. **11**A is a cross-sectional view, taken along the line **11**A-**11**A of FIG. **10**;

FIG. **11**B is a cross-sectional view, taken along the line **11**B-**11**B of FIG. **10**;

FIG. **12** is a left side elevation view of a portion of the left footrest of FIG. **8**; and

FIG. **13** is a left side elevation view of a portion of the snowmobile of FIG. **1** shown in a trenching configuration, with a snow flap of the snowmobile in a pivoted position;

FIG. **14** is a left side elevation view of a snowmobile frame, fuel tank and seat in accordance with another implementation;

FIG. **15** is a left side elevation view of the snowmobile frame and fuel tank of FIG. **14** with the seat being removed for clarity;

FIG. **16**A is a cross-sectional view taken along the line **16**A-**16**A of FIG. **14**;

FIG. **16**B is a cross-sectional view taken along the line **16**B-**16**B of FIG. **14**;

FIG. **17** is a cross-sectional view taken along the line **17**-**17** of FIG. **15**;

FIG. **18** is a left side elevation view of a left leg of an upper rear support of the frame of FIG. **14**;

FIG. **19**A is a slice taken along the line **19**A-**19**A of FIG. **18**;

FIG. **19**B is a slice taken along the line **19**B-**19**B of FIG. **18**;

FIG. **19**C is a slice taken along the line **19**C-**19**C of FIG. **18**;

FIG. **20** is a slice taken along the line **20**-**20** of FIG. **15**;

FIG. **21** is a perspective view, taken from a rear, top and left side, of the frame and footrests of FIG. **14**;

FIG. **22** is an exploded perspective view, taken from a rear, top and left side, of the left footrest of FIG. **21**;

FIG. **23** is a top plan view of a portion of the left footrest of FIG. **22**; and

FIG. **24** is a cross-sectional view taken along the line **24-24** of FIG. **23**.

DETAILED DESCRIPTION

Referring to FIG. **1**, a snowmobile **10** includes a forward end **12** and a rearward end **14** which are defined consistently with a travel direction of the vehicle **10**. The snowmobile **10** includes a vehicle body in the form of a frame or chassis **16** which includes a rear tunnel **18**, an engine cradle **20**, a front suspension module **22** and an upper support structure **24**. The tunnel **18** defines a longitudinal centerplane **13** (longitudinally disposed vertical plane, FIGS. **2**C and **2**D) of the snowmobile **10**. The frame **16** will be described in further detail below.

A motor **50** (schematically illustrated in FIG. **1**), which in the illustrated implementation is an internal combustion engine, is carried in an engine compartment defined by the engine cradle **20**. A fuel tank **52**, supported above the tunnel **18**, supplies fuel to the engine **50** for its operation. Coolant used to cool the engine **50** is circulated through heat exchangers **25** (FIG. **2**B) mounted to the tunnel **18**.

An endless drive track **30** is positioned at the rear end **14** of the snowmobile **10**. The drive track **30** is disposed generally under the tunnel **18**, and operatively connected to the motor **50** through a belt transmission system (not shown) and a reduction drive (not shown). The endless drive track **30** is driven to run about a rear suspension assembly **32** connected to the tunnel **18** for propulsion of the snowmobile **10**. The endless drive track **30** has a plurality of lugs **31** extending from an outer surface thereof to provide traction to the track **30**.

The rear suspension assembly **32** includes a drive sprocket **34**, one or more idler wheels **36** and a pair of slide rails **38** in sliding contact with the endless drive track **30**. The drive sprocket **34** (shown schematically in FIG. **1**) is mounted on a drive axle **35** and defines a sprocket axis **34***a*. The slide rails **38** are attached to the tunnel **18** by front and rear suspension arms **40** and one or more shock absorbers **42** which include a coil spring (not indicated) surrounding the individual shock absorbers **42**. It is contemplated that the snowmobile **10** could be provided with a different implementation of a rear suspension assembly **32** than the one shown herein.

A straddle-type seat **60** is positioned atop the fuel tank **52**. It s contemplated that the seat **60** could be positioned on the tunnel **18**. The seat **60** and the fuel tank **58** are connected to the upper support structure **24** of the frame **16** as will be described below in further detail. A fuel tank filler opening covered by a cap **54** is disposed on the upper surface of the fuel tank **52** in front of the seat **60**. It is contemplated that the fuel tank filler opening could be disposed elsewhere on the fuel tank **52**. The seat **60** is adapted to accommodate a driver of the snowmobile **10**. The seat **60** can also be configured to accommodate a passenger. A footrest **64**, in the form of a footboard, is positioned on each side of the snowmobile **10** below the seat **60** to accommodate the driver's feet. The footrest **64** will be described below in further detail.

Two skis **70** positioned at the forward end **12** of the snowmobile **10** are attached to the front suspension module **22** of the frame **16** through a front suspension assembly **72**. The front suspension module **22** is connected to the front end of the engine cradle **24**. The front suspension assembly **72** includes ski legs **74**, supporting arms **76**, shock absorbers **78** and ball joints (not shown) for operatively connecting to the respective ski leg **74**, supporting arms **76** and a steering column **82**.

A steering assembly **80**, including the steering column **82** and a handlebar **84**, is provided generally forward of the seat **60**. The steering column **82** is rotatably connected to the frame **16**. The lower end of the steering column **82** is connected to the ski legs **74** via steering rods **83** (the left end of the left steering rod **83** can be seen in FIG. **1**). The handlebar **84** is attached to the upper end of the steering column **82**. The handlebar **84** is positioned in front of the seat **60**. The handlebar **84** is used to rotate the steering column **82**, and thereby the skis **70**, in order to steer the vehicle **10**. A throttle operator (not shown) in the form of a thumb-actuated throttle lever is mounted to the right side of the handlebar **84**. Other types of throttle operators, such as a finger-actuated throttle lever and a twist grip, are also contemplated. A brake actuator (not indicated), in the form of a hand brake lever, is provided on the left side of the handlebar **84** for braking the snowmobile **10** in a known manner.

At the rear end of the snowmobile **10**, a rear bumper **90** and a snow flap **92** are connected to the rear end of the tunnel **18**. The rear bumper **90**, in the form of an inverted U-shaped tubular structure, extends above the rear end of the tunnel **18**. The snow flap **92** extends downward from the rear end of the tunnel **18**. The snow flap **92** protects against snow that can be projected upward from the drive track **30** when the snowmobile **10** is being driven. The snow flap **92** extends rearwardly from its front end which is disposed between the tunnel **18** and the rear bumper **90**, and then extends downwardly. The downwardly extending portion of the snow flap **92** defines a surface facing the track **30** that is arcuate. The lower end of the snow flap **92** is disposed rearward of the rearmost point of the drive track **30**. As such, during operation of the snowmobile **10**, some of the snow projected rearward by the drive track **30** is redirected upwardly and forwardly so as to be projected onto the heat exchanger **25** connected to the tunnel **18** to improve cooling.

As can be seen in FIG. **13**, the snow flap **92** can also pivot and bend relative to the tunnel **18**. Under certain conditions, it is possible for the drive track **30** to have reduced traction with the surface on which it travels. Should this surface be deep loose snow, the drive track **30** can start digging into the snow thereby forming a trench until it regains traction, which is sometimes referred to as trenching. In prior art snowmobiles, the tunnel **18** and/or the rear bumper **90** extends further rearward than in the snowmobile **10** described herein. As a result, after a certain amount of trenching, the rear portion of the tunnel **18** and/or of the rear bumper **90** can sit on the edge of the trench dug by the drive track **30**. The snow flap **92** bridging between the end of the tunnel **18** and the bumper **90** increases support for the snowmobile **10** on the edge of the trench. As a result, the snowmobile **10** can no longer move down as the drive track **30** digs the trench, which eventually result in the drive track **30** no longer being capable of digging and losing all traction. This is sometimes referred to as jacking. In the snowmobile of the present implementation, the rearmost point P**1** of the rear bumper **90** is disposed at a distance R**1** from the point P**2** about which the ski **70** pivots relative to the ski leg **74**. The rearwardmost point P**3** of the track **30** is disposed at a distance R**2** from point P**2**. By having R**1** less than R**2**, the

rearmost point of the bumper **90**, which in the present implementation is further back than the tunnel **18**, remains inside the trench T dug by the track **30** and will not sit on the edge of the trench T, thus preventing jacking. Although a portion of the snow flap **92** extending rearward of the bumper **90** may contact the edge to the trench T as shown, since the snow flap **92** is made of flexible material, it bends when the weight of the snowmobile **10** is applied to it, and therefore does not cause jacking.

At the front end **12** of the snowmobile **10**, fairings **94** enclose the motor **50** and the belt transmission system, thereby providing an external shell that not only protects the motor **50** and the transmission system, but can also be decorated to make the snowmobile **10** more aesthetically pleasing. Typically, the fairings **94** include a hood **96** and one or more side panels which can be opened to allow access to the motor **50** and the belt transmission system when this is required, for example, for inspection or maintenance of the motor **50** and/or the transmission system. A windshield **98** connected to the fairings **94** acts as a wind screen to lessen the force of the air on the rider while the snowmobile **10** is moving. The windshield **98** may be connected directly to the handlebar **84**.

The snowmobile **10** includes other components such as a display cluster, an exhaust system, an air intake system, and the like. As it is believed that these components would be readily recognized by one of ordinary skill in the art, further explanation and description of these components will not be provided herein.

The frame **16** will now be described in more detail with reference to FIGS. **2**A to **2**D, **14**, **15**, **20** and **21**. As previously mentioned, the frame **16** of the snowmobile **10** includes the tunnel **18**, the engine cradle **20**, the front suspension module **22**, and the upper structure **24**. The implementation of the frame **16** shown in FIGS. **14**, **15** and **20** is generally similar to the implementation of the frame **16** shown in FIGS. **2**A to **2**D. The differences between the rear legs **350** of FIGS. **14** to **21** and the rear legs **150** of FIGS. **2**A to **2**D will be discussed in detail below. As such all other features of the implementation of the frame **16** in FIGS. **14**, **15** and **20** have been labeled with the same reference numbers as in FIGS. **2**A to **2**D. Some of the differences between corresponding features of the frame **16** of FIGS. **14**, **15** and **20** and the frame **16** of FIGS. **2**A to **2**D will be pointed out throughout the description where relevant.

As best seen in FIGS. **2**D and **20**, the tunnel **18** generally forms an inverted U-shaped structure when viewed from the front or back. With reference to FIGS. **2**A to **2**D, the tunnel **18** includes a top wall **120** extending generally horizontally, a left side wall **122** extending generally vertically and a right side wall **122** extending generally vertically. A left bevel wall **124** connects the left edge of the top wall **120** to the upper edge of the left side wall **122**. A right bevel wall **124** connects the right edge of the top wall **120** to the upper edge of the right side wall **122**. Each bevel wall **124** is planar and extends downwardly and laterally outwardly from the horizontal top wall **120** to the corresponding vertical side wall **122**. Each bevel wall **124** forms an obtuse angle with the horizontal top wall **120**. Each bevel wall **124** also forms an obtuse angle with the corresponding vertical side wall **122**. Each bevel wall **124** allows for connection of a corresponding upper rear support leg **150** as will be described further below. A portion **125** is connected to each side tunnel wall **122** just below the bevel **124** for aesthetic purposes. It is however contemplated that the portion **125** could also be used to support the upper rear support leg **150**. It is contemplated that the portion **125** could be omitted as in the implementation of the tunnel **18** shown in FIGS. **14** and **15**. The tunnel **18** of FIGS. **14** and **15** instead has four trapezoidal openings **302**. It is contemplated that the openings **302** could be omitted, configured differently than as shown herein and/or that the tunnel **18** could have fewer or more than four openings **302**. It is also contemplated that the tunnel **18** could have one or more openings **302** as well as the portion **125**.

As best seen in FIGS. **2**A, **14** and **15**, when viewed from a lateral side, the top wall **120** slopes gently upwardly from the front to the rear of the tunnel **18**. It is contemplated that the entire length of the top wall **120** could be horizontal, or that there could be more than one slope along the length of the tunnel **18**. It is also contemplated that a portion of the top wall **120** could be curved in a lateral or longitudinal direction. With reference to FIGS. **2**B to **2**D, the top wall **120** has a rectangular gap **121** extending longitudinally along the centerplane **13**. The gap **121** extends from the rear end of the tunnel **18** towards the front end of the tunnel **18**. It is contemplated that the gap **121** could be shaped and sized differently than as shown. The heat exchanger **25** is disposed in the gap **121** of the top wall **120**. The coolant flowing through the heat exchanger **25** is cooled by cool air flowing along the upper surface of the heat exchanger **25** disposed in the gap **121** and the snow being thrown upwards onto the lower surface of the heat exchanger **25** by the track **40** disposed below the tunnel **18**.

With reference to FIGS. **2**A to **2**C, **14**, **15** and **20**, a central horizontal arm **90***a* of the bumper **90** is disposed above the top tunnel wall **120** at a rear thereof and the heat exchanger **25**. A left end of the horizontal arm **90***a* is connected to a downwardly and forwardly extending left arm **90***b* and its right end connected to a downwardly and forwardly extending right arm **90***b*. The left arm **90***b* extends downwardly and forwardly along the leftwardly facing (outer) surface of the left tunnel wall **122** to its bottom edge and then bends forward to extend along the outer surface of the left tunnel wall **122** just above the bottom edge thereof. The front end of the left arm **90***b* is disposed forward of the rear end of the left footrest **64**. The front end of the left arm **90***b* is fastened to the left tunnel wall **122** by a fastener **146** (FIG. **20**). The fastener **146** also connects a rear suspension attachment bracket **142** to the left tunnel wall **122** as can be seen in FIG. **20**. The rear suspension attachment bracket **142** connects the rear suspension assembly **32** to the tunnel **18**. The rear suspension attachment bracket **142** has a vertically extending plate **143** disposed against the rightwardly facing (inner) surface of the left tunnel wall **122**. The fastener **146**, in the form of a bolt, is inserted through the vertical plate **143**, and the left tunnel wall **122** into the left arm **90***b* of the bumper **90**. The vertical plate **143** extends lower than the bottom edge of the left tunnel wall **122**. One of the idler wheels **36** is rotatably connected to the lower end of the rear suspension attachment bracket **142** as can be seen in FIG. **1**. It is contemplated that an element other than the idler wheel **36** of the rear suspension assembly **32** could be connected to the rear suspension attachment bracket **142** in addition to, or instead of the idler wheel **36** as shown herein. The rear suspension attachment bracket **142** also includes a horizontally extending plate **144** extending laterally outwardly from a middle portion of the attachment bracket **142**. The horizontal plate **144** is formed integrally with the vertical plate **143** and disposed just below the bottom edge of the left tunnel wall **122**. The right tunnel wall **122** similarly has a right rear suspension attachment bracket **142** fastened to the inner surface by a fastener **146** with an idler wheel **36** being connected to the lower end of the rear suspension attachment

bracket **142**. Although not seen in the figures, the right arm **90***b* similarly extends downwardly and forwardly along the right tunnel wall **122** to its bottom edge, and then bends forward to extend along the bottom edge of the right tunnel wall **122**. The front end of the right arm **90***b* is disposed forward of the rear end of the right footrest **64**. As can be seen in FIG. **17**, the front end of the right arm **90***b* is fastened to the right tunnel wall **122** and the right rear suspension attachment bracket **142** by the fastener **146** as described above for the front end of the left arm **90***b*.

With reference to FIGS. **2**A, **2**B, **14** and **15**, a front portion of the left side wall **122** of the tunnel **18** has an opening **126** which receives the front drive axle **35**. The front portion of the left side wall **122** around the opening **126** is reinforced for additional rigidity, as can be seen when viewed from a lateral side. The left footrest **64** extends leftwardly from the bottom edge of the left side wall **122**, and the right footrest **64** extends rightwardly from the bottom edge of the right side wall **122**. In some implementations of the tunnel **18**, the entire length of the footrest **64** is formed integrally with the tunnel side surfaces **122**. In the implementation of the tunnel **18** shown in FIGS. **2**A to **2**C, **14** and **15**, a front portion **128** of each footrest **64** is formed integrally with the corresponding side wall **122**. A toehold **66** extends upward from the front edge of each footrest **64**. Each of the left and right toeholds **66** has a generally vertical front portion **66***a* that extends upwardly from the front edge of the footrest **64**, a generally horizontal middle portion **66***b* that extends rearwardly from the top of the front portion **66***a* and a rear portion **66***c* that extends upwardly from the rear end of the middle portion **66***b*. A footrest support **62** connects the front end of each footrest **64** to a rear portion **130** of the engine cradle **20**. In the implementation of the footrest **64** shown in FIGS. **14**, **15**, and **21**, a rear end of the left footrest **64** is fastened to the horizontal plate **144** of the left rear suspension attachment bracket **142** and a rear end of the right footrest **64** is fastened to the horizontal plate **144** of the right rear suspension attachment bracket **142**. The footrest **64** will be described in more detail below.

With reference to FIGS. **2**A to **2**C, the engine cradle **20** is attached to the front end of the tunnel **18** and extends forwardly therefrom. In the illustrated implementation of the engine cradle **20**, the rear portion **130** of the engine cradle **20** extends generally vertically and is connected to the front of the tunnel **18**. A generally horizontal bottom portion **132** of the engine cradle **20** extends forwardly from the bottom of the rear portion **130**, and a generally vertical front portion **134** rises upwards from the bottom portion **132** of the engine cradle **20**. The motor **50** is supported by the engine cradle **20** in a manner which would be determined by the size and shape of the motor **50**. Engine cradles having different shapes and including components different than as described above are also contemplated. The motor **50** can be supported on the bottom portion **132** of the engine cradle **20** or can also be solely and/or simultaneously supported by other areas of the engine cradle **20**, tunnel **18** and/or front suspension module **22**. On the right side of the engine cradle **20**, as best seen in FIGS. **2**A and **2**C, a generally horizontal upper bar **136** extends between the upper ends of the front and rear portions **134**, **130** of the engine cradle **20**. The upper bar **136** is spaced from the generally horizontal bottom portion **132** in order to provide additional structural rigidity to the engine cradle **20**. In the illustrated implementation, although not shown for clarity, an upper bar is also provided on the left side of the engine cradle **20** connecting the front and rear portion **134**, **130** and being spaced from the bottom portion **132**. It is contemplated that the engine cradle **20** could be configured differently than as shown herein.

With reference to FIGS. **2**A to **2**C, **14** and **15**, the front suspension module **22**, which attaches the front suspension assembly **16** to the snowmobile **10**, is attached to the front portion **134** of the engine cradle **20**. The front suspension module **22** extends forwardly from the engine cradle **20**. The front suspension module **22** includes left and right front suspension mounting brackets **140**. Each bracket **140** forms an inverted generally V-shaped structure extending forwardly from the front portion **134** of the engine cradle **20**. The corresponding front suspension assembly **72** is attached to each front suspension mounting bracket **140**. Other types of suspension mounting brackets are also contemplated to accommodate a different type of front suspension assembly **72**. The front suspension module **22** and the engine cradle **20** also support a portion of an exhaust system (not shown) connected to the engine **50**.

With reference to FIGS. **2**A to **2**D, **14** and **15**, the upper support structure **24** includes an upper front support **102**, an upper column **103**, and an upper rear support **104**. The upper front support **102** includes left and right front support braces **108**. The lower end of each of the left and right front support braces **108** is attached to the corresponding one of the left and right front suspension mounting bracket **140** at its upper end (apex of the inverted V-shaped bracket **140**). A laterally extending frame member **107** connects between the lower ends of the two front support braces **108**. The frame member **107** is also connected to the top of the front suspension mounting brackets **140**. The apex of the left mounting bracket **140**, the left end of the frame member **107** and the bottom end of the left front support brace **108** are connected together at a common connection point **141** on the left side. Similarly, the apex of the right mounting bracket **140**, the right end of the frame member **107** and the bottom end of the right front support brace **108** are connected together at a common connection point **141** on the right side. Each front support brace **108** extends upwards, rearwards and laterally inwards to a steering bracket **148** positioned above the engine cradle **20**. The steering column **82** is rotatably inserted through the steering bracket **148** between the braces **108**. The steering column **82** extends downwards and forwards from the handlebar **84** through the steering bracket **148** to the front suspension assembly **72** (connection not shown in figures) for rotating the skis **70** and steering the snowmobile **10**. In the implementation of the frame **16** shown in FIGS. **14** and **15**, the steering bracket **148** does not extend as far forwardly of the upper end of the braces **108** as the steering bracket **148** of the frame **16** in FIGS. **2**A to **2**D. The steering bracket **148** of FIGS. **14** and **15** also does not extend as far forwardly of the upper end of the braces **108** as steering bracket **148** of FIGS. **2**A to **2**D. The front support braces **108** are formed as extruded hollow tubes made of metal or other suitably strong materials, however, the disclosure is not intended to be limited to this particular material, assembly method or configuration. For example, it is contemplated that the forward support braces **108** could have a different cross-section or be made by molding or casting. It is also contemplated that the forward support braces **106** may be constructed according to a monocoque or pseudo-monocoque technique instead of having a tubular construction as in the illustrated implementation.

With reference to FIGS. **2**A to **2**C, **14** and **15**, an upper column **103** connects the forward support braces **108** to the engine cradle **20**. The upper column **103** includes a left leg **118** and a right leg **118**. The upper end of the left leg **118** is connected to the left front support brace **108** just below the

upper end of the left front support brace **108** which is connected to the steering bracket **148**. From the left front support brace **108**, the left leg **118** extends downwardly, rearwardly and leftwardly to the upper left hand corner of the engine cradle rear portion **130**. The upper end of the right leg **118** is similarly connected to the right front support brace **108** just below the upper end of the right front support brace **108** which is connected to the steering bracket **148**. From the right front support brace **108**, the right leg **118** extends downwardly, rearwardly and rightwardly to the upper right hand corner of the engine cradle rear portion **130**. In the illustrated implementation, each of the upper column legs **118** is in the form of a straight, tubular rod, but it is contemplated that the legs **118** could also have a bend or a curve. For example, each leg **118** could extend upwardly from the engine cradle **20** and then laterally inwardly to the steering bracket **148**. It is also contemplated that the legs **118** could not be tubular, for example, the legs **118** could be in the form of a solid rod. It is further contemplated that the upper column could be constructed as a single inverted U-shaped structure having two legs **118**.

The upper rear support **104** will now be described with reference to FIGS. **3** to **5**B. The upper rear support **104** includes a pair of rear support legs **150**, referred to hereinafter as legs **150**, for convenience. The left leg **150** is similar to a mirror image of the right leg **150** and as such, corresponding features of the left and right legs **150** have been labelled with the same reference numbers, and only the left leg **150** will be described herein.

As can be seen in FIG. **3**, the leg **150** has an upper end **152** and a lower end **154**. With reference to FIG. **2**A, the upper end **152** of the leg **150** is disposed longitudinally rearward of the upper end of the upper column leg **118** and longitudinally forward of the lower end thereof. The upper end **152** is connected to the steering bracket **148**. The lower end **154** is connected to the bevel wall **124** in a middle portion of the tunnel **18** between the front and rear ends of the tunnel **18**. The fuel tank **52** and seat **60** are connected to a middle portion of the legs **150** between the upper and lower ends, **152** and **154**, thereof as can be seen in the implementation of the leg **350** shown in FIGS. **14** and **15**. The connection of the seat **60** and fuel tank **52** will be described below in further detail with respect to FIGS. **14** to **19**B.

With reference to FIGS. **4**A to **4**C, between the upper and lower ends **152** and **154**, the leg **150** has a C-shaped cross-section with an open channel **160** facing laterally inwardly towards the opposite (right) leg **150**. The channel **160** is defined by a front wall **157**, a side wall **158**, and a rear wall **159**. A left side portion of the fuel tank **52** is disposed in the channel **160** as can be seen in the implementation of the leg **350** shown in FIGS. **14** to **20**. The leg **350**, and the connection thereto of the fuel tank **52** and seat **60** will be described below in further detail.

With reference to FIG. **3**, the side wall **158** is generally planar below the upper end **152**. The side wall **158** extends generally longitudinally between a front edge **158***a* and a rear edge **158***b*. The side wall **158** has a lower edge **158***d* which extends from the front edge **158***a* to its rear edge **158***b*. The lower edge **158***d* is disposed generally parallel to the top wall **120** of the tunnel **18** when the rear leg **150** is mounted to the tunnel **18**. A through-hole **166** is defined in a recess **180** disposed near the front corner of the side wall **158** between the front edge **158***a* and the lower edge **158***d*. Another through-hole **168** is defined in a recess **190** disposed near the rear corner of the side wall **158** between the rear edge **158***b* and the lower edge **158***d*. Bolts **186**, **188** are respectively inserted through the holes **166**, **168** to connect the side wall **158** to the bevel wall **124** of the tunnel **18** as can be seen in FIG. **2**A. The angle, with respect to the vertical, of the bevel wall **124** of the tunnel **18** generally corresponds to the inclination angle of the side wall **158**, with respect to the vertical. The side wall **158** can thus be directly fastened to the bevel wall **124** without using any additional brackets. The recesses **180**, **190** and the connection of the leg **350** to the bevel wall **124** will be described further below with respect to the implementation of the leg **350** shown in FIGS. **14**, **15** and **17**.

With reference to FIG. **3**, a number of apertures **156** are defined in the middle portion of the side wall **158** to reduce the weight of the leg **150**. The apertures **156** are formed by punching the side wall **158**. The side wall **158** bends laterally inwardly around the edges of each aperture **156** as can be seen in FIG. **4**C to form a flange around the aperture **156**. The flanged apertures **156** increase the rigidity of the leg **150**.

With reference to FIG. **3**, the side wall **158** tapers towards the upper end **152**. The front and rear edges **158***a*, **158***b* of the side wall **158** define a side wall width **162** therebetween. The side wall width **162** is measured perpendicular to a centerline **153** of the side wall **158**. As the side wall **158** extends downwardly from its upper end **152**, its front edge **158***a* moves further away from its rear edge **158***b*. The side wall width **162** thus increases from the upper end **152** towards its lower edge **158***d*. The rear edge **158***b* is linear while the front edge **158***a* is linear above and below a bend **165** near the lower end **154**. Below the bend **165**, the front edge **158***a* moves further away from the rear edge **158***b* such that the side wall width **162** increases abruptly at the bend **165**.

With reference to FIGS. **3** to **4**C, the front wall **157** extends laterally inwardly from the front edge **158***a* of the side wall **158** to an inner edge **157***a*. The front wall **157** has a lower edge **157***d* that is spaced from the side wall lower edge **158***d*. As best seen in FIG. **2**A, the front wall lower edge **157***d* is adjacent the top wall **120** of the tunnel **18**. The front wall **157** has a bend **167** (FIG. **3**) connected to the bend **165** of the side wall front edge **158***a*. The front wall **157** is generally planar above the bend **167**. It is contemplated that the entire length of the front wall **157** could be planar.

With reference to FIGS. **3** to **4**C, the rear wall **159** extends laterally inwardly from the rear edge **158***a* of the side wall **158** to an inner edge **159***a*. The rear wall **159** is also generally planar between the upper and lower ends **152**, **154**. The rear wall **159** has a lower edge **159***d* that is spaced from the lower edge **158***d* of the side wall **158**. As best seen in FIG. **2**A, the rear wall lower edge **159***d* is adjacent the top wall **120** of the tunnel **18**.

With reference to FIGS. **4**A to **4**C, the front wall **157** and the rear wall **159** extend from the side wall **158** at an obtuse angle but it is also contemplated that the front and rear walls **157**, **159** could be perpendicular to the side wall **158**. A width **164** of the leg **150** can be defined between the inner edge **157***a* of the front wall **157** and the inner edge **159***a* of the rear wall **159** and measured in a plane perpendicular to the side wall **158** in a direction perpendicular to the centerline **153**. The leg width **164** also increases from its upper end **152** towards its lower end **154**.

With reference to FIGS. **2**C, **5**A and **5**B, the leg **150** extends generally vertically and longitudinally in the upper end **152** but does not extend laterally inwardly. It is contemplated that the upper end of the leg **150** could also extend laterally inwardly. The longitudinally extending surface in the upper end **152** is also recessed in a laterally inward direction. A pair of through-holes **161** is defined in the upper

end **152**. Bolts (not shown) are inserted into the through-holes **161** for fastening the steering bracket **148** to the leg **150**. It is contemplated that the upper end **152** could be structured differently than as shown herein.

Another implementation of an upper rear support **104** having legs **150'** will now be described with reference to FIGS. **6** to **7**C. The left leg **150'** is similar to a mirror image of the right leg (not shown) and as such only the left leg **150'** is shown and described herein. In addition, the left leg **150'** is similar to the left leg **150** described above. Corresponding features of the legs **150**, **150'** have been labeled with the same reference numbers and will only be discussed herein with respect to their differences.

With reference to FIG. **6**, the left leg **150'** has an upper end **152** and a lower end **154**, a front wall **157**, a rear wall **159** and a side wall **158** extending therebetween.

The side wall **158** of the leg **150'** is generally similar to the side wall **158** of the leg **150** except that the apertures **156** have been omitted from the leg **150'** and a shallow elongated recess **155** has been added to the side wall **158** of the leg **150'**. The elongated recess **155** extends upwards from the lower end **154** to a middle portion of the side wall **158**. The recess **155** is disposed closer to the front edge **158***a* than to the rear edge **158***b* but it is contemplated that the recess **155** could be centered between the edges **158***a*, **158***b* or disposed closer to the rear edge **158***b*. The elongated recess **155** has a uniform width except for a wider portion disposed closer to the lower end **154**. The shape and size of the recess **155** could be different than as shown herein. The recess **155** could be formed as multiple recesses, and/or additional recesses could also be provided in a different location along the side wall **158**.

With reference to FIGS. **6** to **7**C, the front wall **157** of the leg **150'** has a first planar portion **177** extending laterally inwardly from the front edge **158***a* and a second planar portion **172** extending laterally inwardly from the first planar portion **177** to a laterally inner edge **157***a* of the front wall **157**. The first planar portion **177** is disposed at an obtuse angle with respect to the planar side wall **158** and the second planar portion **172** is disposed generally perpendicular to the planar side wall **158**. The first planar portion **177** therefore forms an angled front bevel wall **177** of the rear leg **150'**. The rear wall **159** similarly has a first planar portion **179** extending laterally inwardly from the rear edge **158***b* and a second planar portion **174** extending laterally inwardly from the first planar portion **179** to a laterally inner edge **159***a* of the rear wall **159**. The first planar portion **179** is disposed at an obtuse angle with respect to the planar side wall **158** and the second planar portion **174** is disposed generally perpendicular to the planar side wall **158**. The first planar portion **179** therefore forms an angled rear bevel wall **177** of the rear leg **150'**. It is contemplated that the front and rear bevel walls **177**, **179** could each be disposed at a different angle with respect to the planar side wall **158** than as shown herein. It is also contemplated that either or both of the first planar portions **177**, **179** could not be disposed generally perpendicular to the side wall **158**.

Thus, the leg **150'** of FIGS. **6** to **7**C also has a generally C-shaped cross-section, but the C-shaped cross-section is formed by five generally planar surfaces **172**, **177**, **158**, **179**, and **174** instead of three generally planar surfaces **157**, **158**, and **159** as in the leg **150** of FIGS. **3** and **4**. As the shape of the channel **160** defined by the rear leg **150'** is slightly different from that of the channel **160** defined by the rear leg **150**, the fuel tank (not shown) used with the rear leg **150'** has a side portion disposed in the channel **160** and congruous with the inward facing surfaces of the walls **172**, **177**, **158**, **179**, **174** that is slightly different from the side portion of the fuel tank **52** used with the implementation of the rear leg **150**.

With reference to FIGS. **6** to **7**C, a leg width **164** can also be defined for the leg **150'**. The leg width **164** is measured between the laterally inner edge **157***a* of the front wall **157** and the laterally inner edge **159***a* of the rear wall **159** in a plane perpendicular to both walls **157**, **159**. The leg width **164** increases from the upper end **152** toward the lower end **154**.

The upper rear support **104** of FIGS. **14** and **15** has another implementation of legs **350** which will now be described with reference to FIGS. **14** to **21**.

The left leg **350** is generally a mirror image of the right leg **350** (FIG. **21**), and as such only the left leg **350** is described herein. In addition, the left leg **350** is similar to the left leg **150'** described above. As such, features of the leg **350** have been labeled with the same reference numbers as the corresponding features of the leg **150'**, except that the first digits of the reference number have each been changed from "1" to "3". The left leg **350** will only be described herein in detail with respect to some of the differences with the left leg **150'** discussed above.

With reference to FIG. **14**, the upper end **352** of the leg **350** is generally longitudinally aligned with the upper end of the upper column leg **118** and is disposed longitudinally forwardly of the lower end thereof. The leg **350** is connected to the steering bracket **148** by two bolts (not shown) inserted through through-holes **361** (FIG. **18**) defined in the upper end **352**.

A bracket **376** extends downwardly from the edge **157***a* of the front wall **157**. The bracket **376** is generally triangular in shape and disposed in the middle portion of the leg **350**, closer to the lower end **354** than to the upper end **352**. The bracket **376** has a through-hole **378** formed therein and is used to connect a panel (not shown) of the fairings **94** to the left leg **350**.

The lower end **354** of the leg **350** is connected to the bevel surface **124** in a middle portion of the tunnel **18** between the front and rear ends of the tunnel **18**. In the lower end **354**, the side wall **358** has a recess **380** (similar to the recess **180** of the legs **150**, **150'**) disposed near the front corner defined by the front edge **358***a* and the lower edge **358***d*, and a recess **390** (similar to the recess **190** of the legs **150**, **150'**) disposed near the rear corner defined by the rear edge **358***b* and the lower edge **358***d*.

With reference to FIG. **19**A, the recess **380** is circular and defined by a planar inner wall **384** and a cylindrical peripheral wall **382**. The inner wall **384** is spaced from the planar side wall **358** and disposed laterally inwardly thereof. The inner wall **384** extends generally parallel to the planar portion of the side wall **358**. The peripheral wall **382** extends laterally outwardly from the edge of the inner wall **384** to the planar portion of the side wall **358**. A through-hole **366** is defined in the inner wall **384** of the recess **380**. A bolt **386** is inserted through the hole **366** to fasten the leg **350** to the bevel surface **124** of the tunnel **18** as can be seen in FIG. **17**.

The recess **390** is similarly circular and defined by a planar inner wall **394** and a cylindrical peripheral wall **392**. The inner wall **394** is spaced from the planar side wall **358** and disposed laterally inwardly thereof. The inner wall **394** extends generally parallel to the planar portion of the side wall **358**. The peripheral wall **392** extends laterally outwardly from the edge of the inner wall **394** to the planar portion of the side wall **358**. A through-hole **368** is defined in the planar wall **394** of the recess **390**. A bolt **388** is

inserted through the hole **368** to fasten the leg **350** to the bevel surface **124** of the tunnel **18** as can be seen in FIG. **17**.

As can be seen in FIG. **17**, when the leg **350** is mounted to the tunnel **18**, the bevel surface **124** is in contact with the planar inner recess walls **384**, **394** and spaced from the planar portions of the side wall **358** in the lower end **354**. In the illustrated implementation, the planar side wall **358** along the entire length of the leg **350** below the upper end **352** extends generally parallel to the bevel surface **124**. It is contemplated that the planar side wall **358** could not be parallel to the inner recess walls **384**, **394** and the bevel surface **124**.

As can be seen in FIG. **17**, below the top surface **120** of the tunnel **18**, inner edges **357***a* and **359***a* of the walls **357** and **359** extend laterally inwards from the side wall **358** towards the bevel wall **124**. In the illustrated implementation, the bevel wall **124** does not contact the edges **357***a*, **359***a* of the front and rear wall **357**, **359**. It is contemplated that the edges **357***a*, **359***a* could contact the bevel wall **124**. Above the top wall **120** of the tunnel **16**, the edges **357***a*, **359***a* of the front and rear walls **357**, **359** are spaced further from the side wall **358** than they are below the top wall **120**. As can be seen in FIG. **21**, above the tunnel **18**, the inner edge **357***a* is disposed laterally inwardly of a left bevel plane **480** containing the left bevel wall **124**. The left bevel plane **480** intersects the front and rear walls **357**, **358** of the left leg **350** above the tunnel **18** such that the side wall **358** is disposed on an opposite of the left bevel plane **480** than the inner edges **357***a*, **359***a*. Although not shown for the leg **350**, a right bevel plane **480** (FIG. **2**D) containing the right bevel wall **124** similarly intersects the front and rear walls **357**, **358** of the right leg **350** above the tunnel **18**.

As can be seen in FIG. **2**D, the left bevel plane **480** also intersects the front and rear walls **157**, **159** of the left leg **150** above the tunnel **18** such that the side wall **158** is disposed on an opposite of the right bevel plane **480** than the inner edges **157***a*, **159***a* of the left leg **150**. The right bevel plane **480** similarly intersects the front and rear walls **157**, **159** of the right leg **150** above the tunnel **18** such that the side wall **158** is disposed on an opposite of the right bevel plane **480** than the inner edges **157***a*, **159***a* of the right leg **150**. The inner edges **157***a*, **159***a* are disposed laterally inwardly of the corresponding one of the left and right bevel plane **480**. As can be seen in FIG. **2**D, the intersection of the left bevel plane **480** with the rear wall **159** of the left leg **150** extends along the entire length of the left leg **150** above the tunnel **18**. Although not shown, the intersection of the right bevel plane **480** with the front wall **157** extends along the entire length of the left leg **150** above the tunnel **18**. Although not shown, the intersection of the left bevel plane **480** with the front wall **157** extends along the entire length of the left leg **150** above the tunnel **18**. Similarly, the intersection of the right bevel plane **480** with the front and rear walls **157**, **159** extends along the entire length of the right leg **150** above the tunnel **18**. It is contemplated that the intersection of each of the left and right bevel walls **480** with the front and rear walls **157**, **159** could extend along only a portion of the corresponding leg **150** above the tunnel **18**.

With reference to FIGS. **14** and **15**, the planar side wall **358** has an elongated recess **355** extending between the front and rear edges, **358***a* and **358***b*, and between the upper and lower ends, **352** and **354**. The upper end of the recess **355** is disposed just below the upper end **352** of the leg **350** and the lower end of the recess **355** is disposed just above the lower end **354**. The recess **355** has a wider portion **400** which has a through-hole **402** defined therein. The wider portion **400** is disposed slightly higher than the bracket **376** of the leg **350**.

With reference to FIGS. **15** to **16**A, a fastener **404** is inserted through the through-hole **402** into the fuel tank **52** to fasten the fuel tank **52** to the leg **350**. The fastener **404** is in the form of a bolt having a bolt head **406** connected to a threaded shank **408** extending laterally inwardly through the hole **402** into the fuel tank **52**. On the side opposite the threaded shank **408**, the bolt head **406** has a projection **410** extending laterally outwardly from a laterally outer surface (the surface opposite the threaded shank **408**) of the bolt head **406** to a spherical outer end **412**.

With reference to FIGS. **14** to **16**B, the fuel tank **52** has a body **420** having a left side portion **422** and a right side portion **422**. The left side portion **422** is complementary to the channel **360** of the left leg **350** and received therein. The right side portion **421** is complementary to the channel **360** of the right leg **350** and received therein. The channel **360** of each leg **350** encloses the corresponding side portion **422** of the fuel tank body **420**. The fuel tank body **422** has recessed portions that receive the front and rear walls **357**, **359** extend laterally inwardly away from the side wall **358**. In the illustrated implementation, the longitudinal walls **357**, **358**, **359** of the leg **350** are spaced from the outer surface of the corresponding side portion **422** (see FIGS. **16**A and **16**B) except in the wider recess portion **400** (see FIG. **16**A). It is contemplated that the portions of the leg **350** other than in the wider recess portion **400** could be in contact with the outer surface of the side portion **422** of the fuel tank body **420**. A metal insert **424** is molded into the left side portion **422** aligned with the wider recess portion **400**. The insert **424** has an internally threaded elongated opening **426** which engages the threaded shank **408** of the fastener **404** to thereby fasten the fuel tank **52** to the left leg **350**. The right side portion **422** similarly has a metal insert **424** with an internally threaded opening **426** engaging a right fastener **404** to fasten the right side of the fuel tank **52** to the right leg **350**.

The seat **60** has a left side portion **430** disposed on the laterally outwardly facing surface of the side wall **358** such that the leg **350** is disposed between the left side portion **430** of the seat **60** and the left side portion **422** of the fuel tank body **420**. The spherical outer end **412** of the projection **410** is received in a complementary slot **432** formed in a surface of the left side portion **430** facing laterally inwardly towards the leg **350** and the spherical outer end **412**. The slot **432** engages the spherical outer end **412** of the fastener **404** to fasten the seat **60** to the left leg **350**. The right fastener **404** also has a spherical outer end **412** which is similarly engaged by a slot **432** formed in a laterally inwardly facing surface of the right side portion **430** of the seat **60** to fasten the seat **60** to the right leg **350**.

In all implementations of the leg **150**, **150'**, **350** discussed above, the entire left leg **150**, **150'**, **350** including the upper end **152**, **352** connected to the steering bracket **148** and the lower end **154**, **354** connected to the tunnel **18**, is formed as a single integral structure. The left leg **150**, **150'**, **350** is formed from a single piece of sheet metal structure that is bent to create the structure described above. The various apertures **156**, **166**, **168**, **161** and recesses **155**, **180**, **190** are created by punching, stamping, or drilling, which can be done either before or after bending the sheet metal.

Forming the entire leg **150**, **150'**, **350** out of a single piece of sheet metal allows the upper end **152**, **352** and the lower end **154**, **354** of the leg **150**, **150'**, **350** to be connected to other vehicle portions (steering bracket **148** and tunnel **18** respectively) directly without the need for using separate attachment brackets as in the case of tubular braces such as the front support braces **108**. With tubular braces, casted end

portions are welded to the respective upper and lower ends of the tubes to allow their respective attachment to the steering bracket **148** and to the tunnel **18**. Connecting the leg **150**, **150'**, **350** directly to the other snowmobile portions without using additional brackets helps to reduce the overall weight of the snowmobile **10**, and also to reduce complexity and cost in the fabrication and assembly thereof.

As mentioned above, the side wall **158**, **358** below the upper end **152**, **352** is flat and constructed without any bends in it. This flat, planar structure of the side wall **158** helps to reduce the risks of developing cracks or breaks at the location of the bend, especially in legs made of materials such as aluminum which have less fatigue strength than steel.

In addition, having the front wall **157**, **357** and rear wall **159**, **359** being angled with respect to the side wall **158**, **358** and extending from the side wall **158**, **358** along the entire length thereof below the upper end **152**, **352** helps to increase the inertial strength and rigidity of the legs **150**, **150'**, **350**. The legs **150**, **150'**, **350** described above, having front **157**, **357**, side **158**, **358** and rear walls **159**, **359** made of bent sheet metal, provide greater strength and resistance to forces of compression and torsion than an unbent sheet metal structure.

The footrests **64** will now be described in further detail with reference to FIGS. **2**B, **2**C, and **8** to **12**.

With reference to FIGS. **2**B, **2**C and **8** to **12**, the left footrest **64** is similar to a mirror image of the right footrest **64**, and as such only the left footrest **64** will be described herein in detail. It is contemplated that the left and right footrests **64** could not be mirror images of each other.

With reference to FIGS. **8** to **10**, the left footrest **64** includes a grid structure **201** formed of interconnected ribs **202**, **204** defining large holes **203** therebetween. The ribs **202**, **204** include longitudinal ribs **202** and lateral ribs **204**. The longitudinal ribs **202** extend in a longitudinal direction and the lateral ribs **204** extend in a lateral direction generally perpendicular to the longitudinal ribs **204**. It is contemplated that the ribs **202** could extend in a direction other than longitudinal, the ribs **204** could extend in a direction other than lateral (as in the implementation of the footrest **364** shown in FIGS. **14**, **15** and **21** to **24**), and that the ribs **202** could not extend in a direction perpendicular to the ribs **204**. Consecutive longitudinal ribs **202** are connected to each other by lateral ribs **204** extending therebetween in a lateral direction. When the snowmobile **10** is traveling on soft snow and the footrests **64** begin to contact the snow, the large holes **203** help to reduce jacking by allowing snow to pass upwardly therethrough. In addition, the large holes **203** are helpful for clearing snow off the footrests **64** by allowing the snow to fall therethrough. This grid structure **201** of the footrest **64** with interconnected longitudinal and lateral ribs **202**, **204** separated by large holes **203** reduces the weight of the snowmobile **10** without compromising the rigidity and strength of the footrest **64**.

With reference to FIGS. **8** to **10**, the left footrest **64** has three longitudinal ribs **202**, including a left rib **202**, a middle rib **202** and a right rib **202**, each extending in the longitudinal direction. It is contemplated that there could be more or less than three longitudinal ribs **202**. In the illustrated implementation of the footrest **64**, the longitudinal ribs **202** are also equally spaced from one another in the lateral direction. It is also contemplated that the longitudinal ribs **202** could not be equally spaced from one another in the lateral direction. The front edges of all three longitudinal ribs **202** are connected together by a forwardmost lateral rib **240**. The longitudinal ribs **202** extend rearward from the forwardmost lateral rib **240**. The right longitudinal rib **202** extends farther rearward than the middle longitudinal rib **202**, which in turn extends farther rearward than the left longitudinal rib **202**. The left footrest **64** is thus tapered towards the rear. It is contemplated that the longitudinal ribs **202** could be configured differently than as shown herein.

As best seen in FIGS. **2**C and **8** to **10**, the lateral ribs **204** are also disposed parallel to one another when viewed from above. The lateral ribs **204** extend generally perpendicular to the longitudinal ribs **202** and normal to the longitudinal centerplane **13**. As mentioned above, it is contemplated that the lateral ribs **204** could extend at an angle other than perpendicular with respect to the longitudinal ribs **202** and/or the longitudinal centerplane **13**.

With reference to FIGS. **8** to **11**B, each lateral rib **204** has a planar upper surface **204***a*, a planar lower surface **204***b*, a front surface **204***c* and a rear surface **204***d*. It is contemplated that the surfaces **204***a*, **204***b* could not be planar. A lateral rib height **250** (FIGS. **11**A and **11**B) is defined between the upper and lower lateral rib surfaces **204***a*, **204***b*. A lateral rib thickness **252** (FIG. **10**) is defined between the front and rear lateral rib surfaces **204***c*, **204***d*.

With reference to FIGS. **8** to **11**B, each longitudinal rib **202** has an upper surface **202***a*, a lower surface **202***b*, a left surface **202***c* and a right surface **202***d*. A longitudinal rib thickness **260** (FIG. **11**A) is defined between the left and right longitudinal rib surfaces **204***c*, **204***d*. A longitudinal rib height **262** (FIGS. **11**A and **11**B) is defined between the upper and lower longitudinal rib surfaces **202***a*, **202***b*. The upper longitudinal rib surface **202***a* is disposed vertically higher than the upper lateral rib surface **204***a*. The lower longitudinal rib surface **202***b* is disposed vertically lower than the lower lateral rib surface **204***b*, by a vertical distance **264**. The longitudinal rib thickness **260** is smaller than the longitudinal rib height **262**. The longitudinal rib thickness **260** is also smaller than the height **264** of the portion of the longitudinal rib **202** disposed lower than the lower lateral rib surface **204***b*. The portion of the longitudinal rib **202** disposed lower than the lower lateral rib surface **204***b* thus acts like a blade that helps slice through the snow when the footrest **64** makes contact with the snow surface.

With reference to FIG. **10**, each hole **203** has a length **266** measured between two consecutive lateral ribs **204** in a direction parallel to the longitudinal ribs **202**. Each hole **203** has also has a width **268** measured between two consecutive longitudinal ribs **202** in a direction perpendicular to the longitudinal ribs **202**. As can be seen, all of the holes **203** in the illustrated implementation have the same width **268** but different lengths **266**.

With reference to FIGS. **8** to **11**B, the upper longitudinal rib surface **202***a* has several teeth **206** projecting upwardly therefrom. The teeth **206** provide traction to the riders' foot disposed on the footrest **64**. Each tooth **206** extends above the upper longitudinal rib surface **202***a* by a height **272** (FIG. **11**A). The height **272** of the teeth **206** is less than the extension **264** of the longitudinal rib **202** below the lower surface **204***b* of the lateral rib **204**. It is contemplated that the number and configuration of the ribs **202**, **204** could be different than that described herein.

With reference to FIGS. **8** to **12**, the footrest **64** has an inner mounting flange **210** for connecting the footrest **64** to the left side wall **122** of the tunnel **18**. The inner mounting flange **210** forms an inner edge of the footrest **64**. The inner mounting flange **210** is in the form of a plate extending longitudinally and vertically with an inner surface **210***b* (FIGS. **11**A and **11**B) facing laterally inwardly and an outer surface **210***a* facing laterally outwardly. The upper edge

210*c* has several tabs 210*d* extending upwardly therefrom. Some of the tabs 210*d* have through-holes 212 defined therethrough. Bolts (not shown) are inserted through the through-holes 212 and through corresponding holes formed in the left side wall 122 of the tunnel 18 to connect the footrest 64 to the tunnel 18. It is contemplated that other types of fasteners such as rivets, or self-piercing rivets could also be used to fasten the footrest 64 to the tunnel 18. The front edge of the inner mounting flange 210 is connected to the forwardmost lateral rib 240. Several other lateral ribs 204 extends leftwardly (laterally outwardly) from the outer surface 210*a* of the inner mounting flange 210 to the right longitudinal rib 202. The inner mounting flange 210 extends farther rearward than the right longitudinal rib 202. The inner mounting flange 210 is formed integrally with the lateral ribs 204. It is contemplated that the inner mounting flange 210 could be connected to the ribs 202, 204 without being integrally formed therewith.

As best seen in FIG. 12, the left footrest 64 has a bend 242 formed just rearward of the second row of lateral ribs 204. The front portion of the left footrest 201 forward of the bend 242 is bent upwardly with respect to the portion rearward of the bend 242.

With reference to FIGS. 2B and 2C, the left footrest 64 includes a front tunnel extension 128 disposed forward of the grid structure 201. The front tunnel extension 128 extends laterally outwardly from the bottom edge of the left side wall 122. As mentioned above, the front tunnel extension 128 is formed integrally with the tunnel 18 and has a plurality of holes 129. The forwardmost lateral rib 204 is fastened to the rear end of the left tunnel extension 128 so as to form a continuous support for a rider's left foot. The toehold 66 extends upwardly from the front edge of the front tunnel extension 128. The footrest support 62 is also connected to the left (laterally outer edge) of the front tunnel extension 128.

With reference to FIGS. 2B and 2C, the left footrest 64 is also connected to the tunnel 18 by an outer mounting bracket 220 connected to the left side (laterally outer) edge of the left footrest 64 and a rear mounting bracket 230 connected to a rear edge of the outer mounting bracket 220.

As can be seen in FIGS. 8 to 10, the outer mounting bracket 220 extends longitudinally and slightly laterally outwardly from its rear end to its front end. The outer mounting bracket 220 is in the form of a hollow tubular structure formed by extrusion. As best seen in FIGS. 8 and 9, the outer mounting bracket 220 of the illustrated implementation has a rectangular cross-section with a generally horizontal upper surface 220*a* and a generally horizontal lower surface 220*b* connected together by a pair of vertical surfaces 220*c*. The upper surface 220*a* of the outer mounting bracket 220 is ribbed and has teeth 222 projecting upwardly therefrom to provide traction to a rider's left foot. In the illustrated implementation, the outer mounting bracket 220 has three longitudinal rows of teeth 222 formed on its upper surface 220*a*. It is however contemplated that there could be more or less than three rows of teeth 222. A number of tabs 224 extending laterally inwardly from the vertically extending surface 220*c* facing laterally inwardly toward the tunnel 18. The tabs 224 have through-holes defined therethrough. The tabs 224 are connected to the lateral ribs 204 by bolts inserted through the holes of the outer mounting flange tabs 224 and through corresponding holes defined in the left edges of the later ribs 204 as best seen in FIG. 2C.

With reference to FIGS. 8 to 10, a front portion of the outer mounting bracket 220 extends forward of the forwardmost lateral rib 240. The front portion of the outer mounting bracket 220 extends on a left side (laterally outer side) of the left front tunnel extension 128 and is fastened thereto by the tabs 224 to further secure the front portion of the footrest 64 to the tunnel 18.

With reference to FIGS. 8 to 10, the rear mounting bracket 230 has a front portion 232 that extends generally longitudinally, and a rear portion 234 that extends upwardly and rearwardly from the front portion 232. The rear mounting bracket 230 forms a C-shaped channel 236 that is open in a direction facing away from the tunnel 18. The channel 236 extends in the front and rear portions 232, 234 of the rear mounting bracket 230. The rear end of the outer mounting bracket 220 is received in the channel 236 in the front portion 232 such that the inner vertical surface 220*c* of the outer mounting bracket 220 abuts against the inner channel wall of the rear mounting bracket 230. The outer mounting bracket 220 is fastened to the rear mounting bracket 230 by rivets, or other fasteners, inserted through aligned through-holes 244 (FIG. 9) of the inner vertical surface 220*c* of the outer mounting bracket 220 and the inner channel wall of the rear mounting bracket 230. The inner channel wall of the rear portion 234 of the rear mounting bracket 230 abuts the left side wall 122 of the tunnel 18 and is fastened thereto by rivets, or other fasteners, inserted through aligned holes 246 (FIGS. 8 and 9) of the rear portion 234 and the left side tunnel wall 122. The rear end of the outer mounting bracket 220 is thus secured to the tunnel 18 by the rear mounting bracket 230. The rear portion 234 of the rear mounting bracket 230 also has three teeth 248 extending laterally outwardly from the edge of the laterally extending front surface to provide traction to a riders foot. It is contemplated that there could be more or less than three teeth 248.

As can be seen in FIGS. 2A to 2C, the left footrest 64 is thus secured to the tunnel 18 by its left (laterally outer) edge, its rear edge and its right (laterally inner) edge.

With reference to FIGS. 8 to 10, the hollow tubular structure of the outer mounting bracket 220 and the structure of the rear mounting bracket 230 having the open channel 236 help to reduce the weight of the vehicle 10. It is contemplated that the mounting brackets 220, 230 could be configured differently than as shown herein, and connected together differently than as shown herein. It is also contemplated that the rear mounting bracket 230 could be formed integrally with the outer mounting bracket 220.

The various dimensions of the grid structure 201 in the footrest 64 are selected as described below to reduce jacking and increase trenching while still providing appropriate support to a rider's foot disposed on the footrest 64 and without causing any significant increase in the weight of the snowmobile 10.

With reference to FIGS. 11A and 11B, in the illustrated implementation, a ratio R1 of the extension 264 of the longitudinal rib 202 below the lateral rib surface 204*b* to the longitudinal rib thickness 260 is selected to be greater than 1.5 and less than 5.5. In the illustrated implementation of the footrest 64 in FIGS. 8 to 12, the ratio R1 is approximately 3.3.

A ratio R2 of a hole width 268 measured in millimeters to the value of the ratio R1 is selected to be greater than 5.0 and less than 15. In the illustrated implementation, the ratio R2 is approximately 10.

A ratio R3 of the hole width 268 to the extension 264 of the longitudinal rib 202 below the lateral rib surface 204*b* is selected to be greater than 1.0 and less than 6.0. In the illustrated implementation, the ratio R2 is approximately 3.0.

It has been noted that trenching can be increased and jacking can be reduced while still providing appropriate support to a riders foot disposed on the footrest **64** and without causing any significant increase in the weight of the snowmobile **10** if the footrest **64** is configured such that the ratio R**1** is between 1.5 and 5.5, the ratio R**2** is between 5.0 and 15.0, and the ratio R**3** is between 1.0 and 6.0.

The footrest **64** is formed by a process that includes an initial extrusion step. The extrusion step forms a horizontally extending plate (not shown) with parallel ribs **202** and the mounting flange **210**. The ribs **202** extend above and below the horizontal plate while the mounting flange **210** extends upward from an edge of the horizontal plate. The direction of extrusion defines the direction of the ribs **202** and the mounting plate. In the implementation of the footrest **64** shown herein, the ribs **202** are aligned with the longitudinal direction of the vehicle **10** (parallel to the longitudinal centerplane **13**) when the footrest **64** is connected to the vehicle **10**. It is however contemplated that the ribs **202** could extend at an angle to the longitudinal centerplane **13**. For convenience, the process of forming the footrest **64** is described herein referring to the direction defined by the ribs **202** as the longitudinal direction, but the present technology is not to be limited by the adoption of this terminology.

The lateral ribs **204**, and the holes **203** are then created by punching holes through the horizontal extruded plate between the parallel ribs **202**. It is contemplated that the lateral ribs **204** and holes **203** could be created by other methods. The punching step for forming the lateral ribs **204** and the holes **203** is performed by displacing the punch in a vertical direction with respect to the horizontal extrusion plate.

The teeth **206** on the upper surface of the longitudinal ribs **202** and the upward extensions **210***d* of the inner mounting flange **210** are created by a separate punching step in which the punch is displaced laterally with respect to the longitudinal ribs **202** and the extrusion direction. The upward extensions **210***d* of the mounting flange **210** could be created by a separate punching step, in which the punch is displaced laterally with respect to the longitudinal ribs **202** and the extrusion direction. It is also contemplated that the teeth **206** and the upward extensions **210***d* could be created by a different process, such as machining. The upward bend **242** best seen in FIG. **12**, is created after the extrusion and the punching processes.

As mentioned above, the outer mounting bracket **220** is formed by extrusion. The rear mounting bracket **230** is formed by casting and/or stamping.

It is contemplated that the footrests **64** could be formed of any suitable materials and by processes other than as described herein.

With reference to FIGS. **14**, **15** and **21** to **24**, another implementation of footrests **64** will now be described. The footrests **364** of FIGS. **14**, **15** and **21** to **24** have many features similar to the corresponding features of footrests **64** of FIGS. **1** to **2**D and **8** to **12**. As such, features of the footrest **364** similar to the corresponding features of footrests **64** have been labeled with the same reference numbers and will not be described again herein. The footrest **364** will only be described herein in detail with respect to differences from the footrest **64**. The left footrest **364** is similar to a mirror image of the right footrest **364** and as such corresponding features of the left and right footrests **364** have been labeled with the same reference numbers and only the left footrest **364** will be described herein.

The left footrest **364** has a grid structure **201** formed of interconnected ribs **202**, **304** defining large holes **303** therebetween. The longitudinal ribs **202** extend in a longitudinal direction. The ribs **304** extend more in a lateral direction than a longitudinal direction, and are therefore referred to herein as lateral ribs **304**. Consecutive longitudinal ribs **202** are connected to each other by lateral ribs **204** extending therebetween. The lateral ribs **304** extend at a non-perpendicular angle to the longitudinal ribs **204**. It is contemplated that the ribs **202** could extend in a direction other than longitudinal. The holes **303** defined by the ribs **202**, **304** are therefore trapezoidal rather than rectangular in shape as in the footrests **64**.

With reference to FIGS. **22** to **24**, the footrest **364** includes several teeth **306** projecting upwardly from the grid structure **201** and extending vertically higher than the upper surface **204***a* of the lateral ribs **304**. The teeth **306** provide traction to the riders' foot disposed on the footrest **364**. Each tooth **306** is laterally offset from a longitudinal rib **202** and connected thereto by a bridge portion **307** that extends laterally inwardly from the longitudinal rib **202**. Some of the teeth **306** are disposed between consecutive lateral ribs **304** while other teeth **306** extend upward from the upper surface **204***a* of a lateral ribs **304**. The teeth **306** extend above the upper longitudinal rib surface **202***a* by a height **272** (FIG. **11**A). The height **272** of the teeth **306** above the upper lateral rib surface **202***a* is smaller than the extension **264** of the longitudinal rib **202** below the lower lateral rib surface **202***b*. This configuration of the teeth **306** being offset from the longitudinal ribs **202** allows the teeth **306** to be formed in the same extrusion step as the longitudinal ribs **202** thereby eliminating the extra punching step required for forming the teeth **206** of the footrest **64**. This configuration of the teeth **306** therefore allows for a simplification in fabrication of the footrest **364** while still providing traction to a rider's foot disposed on the footrest **364**.

The footrest **364** of FIGS. **21** to **24** is configured such that the values of the ratios R**1**, R**2** and R**3** (discussed above with respect to the footrest **64** of FIGS. **8** to **12**) are similar for the footrest **364** as for the footrest **64**.

With reference to FIGS. **21** to **24**, the footrest **364** has a rear mounting bracket **330**. The rear mounting bracket **330** has an upper portion **332** and a lower portion **334**. An upper end **332***a* of the upper portion **332** is connected to the left side wall **122** of the tunnel **18** by bolts inserted through aligned through-holes of the rear mounting bracket **330** and the left tunnel wall **122**. The upper portion **332** extends downwardly and laterally outwardly from the upper end **332***a* thereof to a lower end **332***b* thereof. The lower end **332***b* of the rear mounting bracket upper portion **332** forms a channel (not shown) that is open towards the front of the snowmobile **10**. The rear end of the outer mounting bracket **220** is received in the channel of the lower end **332***b* and fastened thereto. The rear end of the outer mounting bracket **220** is thus secured to the tunnel **18** by the rear mounting bracket **330**. The upper portion **332** two longitudinally and vertically extending walls **333** extending between the upper and lower ends, **332***a* and **332***b*. The front edge of the laterally outer wall **333** has six teeth **336** extending forwardly therefrom to provide traction to a riders foot. It is contemplated that there could be more or less than six teeth **336**. It is also contemplated that the teeth **336** could be omitted. The lower portion **334** is formed as a flange extending horizontally and laterally inwardly from the lower end **332***b*. The laterally inner end **338** of the flange **334** is connected to the horizontal plate **144** of the rear suspension attachment bracket **142** by a bolt inserted through aligned through holes of the flange **334** and the horizontal plate **144**. The rearwardmost lateral rib **308** of the footrest **364** extend-

ing laterally outwardly and rearwardly from the rear end of the mounting flange **210** has a pair of through-holes **340**. The rearwardmost lateral rib **308** is also connected to the horizontal plate **144** by bolts inserted through the aligned through-holes of the rearwardmost lateral rib **308** and the horizontal plate **144**. In the illustrated implementation, the inner end **338** of the flange **334** is also connected to the rearwardmost lateral rib **308**.

Modifications and improvements to the above-described implementations of the present may become apparent to those skilled in the art. The foregoing description is intended to be exemplary rather than limiting. The scope of the present is therefore intended to be limited solely by the scope of the appended claims.

What is claimed is:

1. A snowmobile comprising:

a frame including a longitudinally extending tunnel;

at least one ski operatively connected to the frame;

an endless drive track operatively connected to the frame;

a motor supported by the frame and operatively connected to the drive track for propelling the snowmobile;

a straddle seat disposed above the tunnel and adapted to accommodate a rider;

a left footrest connected to the tunnel and disposed on a left side thereof;

a right footrest connected to the tunnel and disposed on a right side thereof,

each of the left and right footrests comprising a plurality of interconnected ribs extending generally horizontally, the plurality of ribs comprising:

at least one first rib extending in a first direction, each of the at least one first rib comprising an upper first rib surface and a lower first rib surface defining a first rib height therebetween, each of the at least one first rib comprising a pair of vertical first rib surfaces extending generally in a vertical direction between the upper and lower first rib surfaces, the pair of vertical first rib surfaces defining a first rib thickness therebetween, the first rib height being greater than the first rib thickness; and

at least one second rib connected to the at least one first rib, each of the at least one second rib extending in a second direction, the second direction being at an angle with respect to the first direction; and

at least one hole, the at least one first rib and the at least one second rib defining the at least one hole therebetween.

2. The snowmobile of claim **1**, wherein for each portion of any one of the at least one first rib having any one of the at least one second rib connected thereto,

the lower first rib surface of that portion is disposed vertically lower than the one of the at least one second rib connected thereto.

3. The snowmobile of claim **2**, wherein for each portion of any one of the at least one first rib having any one of the at least one second rib connected thereto,

the lower first rib surface is disposed vertically lower than the one of the at least one second rib connected thereto by a distance greater than the first rib thickness.

4. The snowmobile of claim **3**, wherein a ratio of the distance to the first rib thickness is greater than 1.5 and less than 5.5.

5. The snowmobile of claim **4**, wherein:

the ratio is a first ratio;

each of the at least one hole has a hole width measured in a direction perpendicular to the first direction; and

a second ratio of the hole width measured in millimeters to the first ratio is greater than 5.0 and less than 15.0.

6. The snowmobile of claim **3**, wherein:

each of the at least one hole has a hole width measured in a direction perpendicular to the first direction; and

a ratio of the hole width to the distance is greater than 1.0 and less than 6.0.

7. The snowmobile of claim **1**, wherein the first direction is a longitudinal direction of the snowmobile.

8. The snowmobile of claim **7**, wherein at a connection between any one of the at least one second rib and any one of the at least one first rib, the lower first rib surface of the one of the at least one first rib is disposed vertically lower than the one of the at least one second rib.

9. The snowmobiles of claim **8**, wherein the lower first rib surface of the one of the at least one first rib is disposed vertically lower than the one of the at least one second rib by a distance greater than the first rib thickness.

10. The snowmobile of claim **7**, wherein the second direction is a lateral direction of the snowmobile.

11. The snowmobile of claim **1**, wherein each of the at least one second rib comprises:

an upper second rib surface and a lower second rib surface, the upper and lower second rib surfaces being spaced from each other in the vertical direction and defining a second rib height therebetween;

a front second rib surface and a rear second rib surface extending between the upper and lower second rib surfaces and defining a second rib thickness therebetween, the second rib thickness being greater than the second rib height.

12. The snowmobile of claim **11**, wherein the second rib thickness is greater than the first rib thickness.

13. The snowmobile of claim **1**, wherein a first distance between two consecutive ones of the at least one first rib is smaller than a second distance between two consecutive ones of the at least one second rib, the first distance being measured in a direction perpendicular to the first direction, the second distance being measured in a direction perpendicular to the second direction.

14. The snowmobile of claim **1**, wherein the at least one first rib is integrally formed with the at least one second rib.

15. The snowmobile of claim **14**, wherein the at least one first rib and the at least one second rib are formed at least in part by extrusion.

16. The snowmobile of claim **15**, wherein the first direction is defined by a direction of extrusion.

17. The snowmobile of claim **1**, wherein each of the left and right footrests further comprises a plurality of teeth, each tooth of the plurality of teeth projecting upwardly from at least one of:

at least one of the at least one first rib; and

at least one of the at least one second rib.

18. The snowmobile of claim **1**, wherein:

the tunnel comprises a left side surface and a right side surface, the plurality of interconnected ribs of the left footrest being disposed leftwardly of the left side surface, the plurality of interconnected ribs of the right footrest being disposed rightwardly of the right side surface; and

each of the left and right footrests further comprises:

a front tunnel extension extending generally horizontally and laterally outwardly from the tunnel and being integrally formed therewith, the plurality of interconnected ribs being disposed rearward of the front tunnel extension;

a mounting bracket connected to a laterally outer edge of the plurality of ribs and removably connected to the front tunnel extension;

an inner mounting flange formed along a laterally inner edge of the corresponding plurality of interconnected ribs and to the corresponding one of the left and right side surfaces of the tunnel; and

an outer mounting bracket connected to a laterally outer edge of the corresponding plurality of interconnected ribs and to a laterally outer edge of the corresponding front tunnel extension; and

a rear mounting bracket connected to the outer mounting bracket and to the corresponding one of the left and right side surfaces of the tunnel.

19. The snowmobile of claim **1**, wherein, when viewed from a top of the snowmobile, each of the left and right footrests tapers in a rearward direction.

20. A footrest adapted to be disposed on a side of a longitudinally extending tunnel of a snowmobile, the footrest comprising:

a plurality of interconnected ribs, the plurality of interconnected ribs comprising:

at least one first rib extending in a first direction, each of the at least one first rib comprising an upper first rib surface and a lower first rib surface defining a first rib height therebetween, each first rib comprising a pair of vertical first rib surfaces extending generally in a vertical direction between the upper and lower first rib surfaces, the pair of vertical first rib surfaces defining a first rib thickness therebetween, the first rib height being greater than the first rib thickness;

at least one second rib connected to the at least one first rib, each of the at least one second rib extending in a second direction, the second direction being at an angle with respect to the first direction; and

at least one hole, the at least one first rib and the at least one second rib defining the at least one hole therebetween.

21. A snowmobile comprising:

a frame including a longitudinally extending tunnel;

at least one ski operatively connected to the frame;

an endless drive track operatively connected to the frame;

a motor supported by the frame and operatively connected to the drive track for propelling the snowmobile;

a straddle seat disposed above the tunnel and adapted to accommodate a rider;

a left footrest connected to the tunnel and disposed on a left side thereof;

a right footrest connected to the tunnel and disposed on a right side thereof,

each of the left and right footrests comprising a plurality of interconnected ribs extending generally horizontally, the plurality of ribs comprising:

at least one first rib extending in a first direction;

at least one second rib connected to the at least one first rib, the at least one second rib extending in a second direction, the second direction being at an angle with respect to the first direction;

at least one hole, the at least one first rib and the at least one second rib defining the at least one hole therebetween; and

at least one tooth projecting upward from the footrest, the at least one tooth being offset from the at least one first rib in the second direction.

22. The snowmobile of claim **21**, wherein each of the at least one tooth is connected to a corresponding one of the at least one first rib via a bridge.

23. The snowmobile of claim **21**, wherein each of the at least one tooth projects upward from an upper surface of a corresponding one of the at least one second rib.

24. The snowmobile of claim **21**, wherein:

each of the at least one first rib comprises an upper first rib surface and a lower first rib surface defining a first rib height therebetween, each of the at least one first rib comprises a pair of vertical first rib surfaces extending generally in a vertical direction between the upper and lower first rib surfaces, the pair of vertical first rib surfaces defining a first rib thickness therebetween, the first rib height being greater than the first rib thickness,

each of the at least one second rib comprises an upper second rib surface and a lower second rib surface, the upper and lower second rib surfaces being spaced from each other in the vertical direction and defining a second rib height therebetween, each of the at least one second rib comprises a front second rib surface and a rear second rib surface extending between the upper and lower second rib surfaces and defining a second rib thickness therebetween, the second rib thickness being greater than the second rib height; and

each of the at least one tooth extends above the at least one upper first rib surface by a distance smaller than the distance between the lower first rib surface and the lower second rib surface.

25. The snowmobile of claim **21**, wherein for each of the left and right footrests:

the footrest is made at least in part by extrusion, the first direction being defined by a direction of extrusion, the at least one tooth being formed at least partially by extrusion.

26. The snowmobile of claim **21**, wherein for each of the left and right footrests:

the at least one first rib is two first ribs being parallel to each other;

the at least one second rib is two second ribs being parallel to each other;

the two first ribs and the two second ribs define the at least one hole therebetween, the at least one hole having a hole width and a hole length; and

at least a portion of the at least one tooth being disposed within the at least one hole.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,738,301 B2
APPLICATION NO. : 14/788624
DATED : August 22, 2017
INVENTOR(S) : Sebastien Vezina et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Claim 9, Column 24, Line 16, “the snowmobiles of” should read -- the snowmobile of --

Signed and Sealed this
Twenty-first Day of November, 2017

Joseph Matal

Joseph Matal
Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office